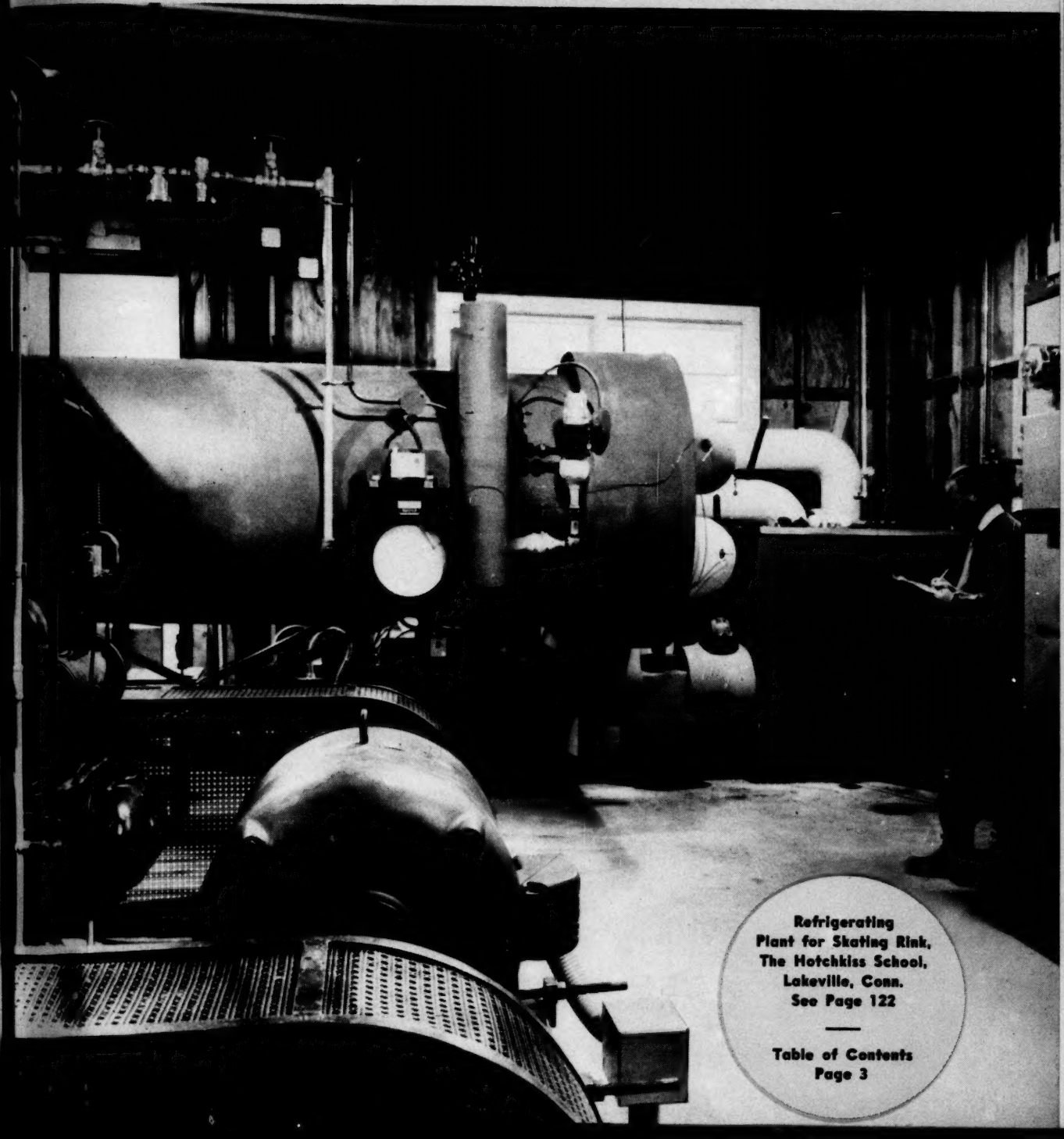
AIR CONDITIONING HEATING AND VENTILATING

SEPTEMBER, 1958—55th Year



Refrigerating Plant for Skating Rink, The Hotchkiss School, Lakeville, Conn.
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WATTS TEMPERATURE REGULATORS

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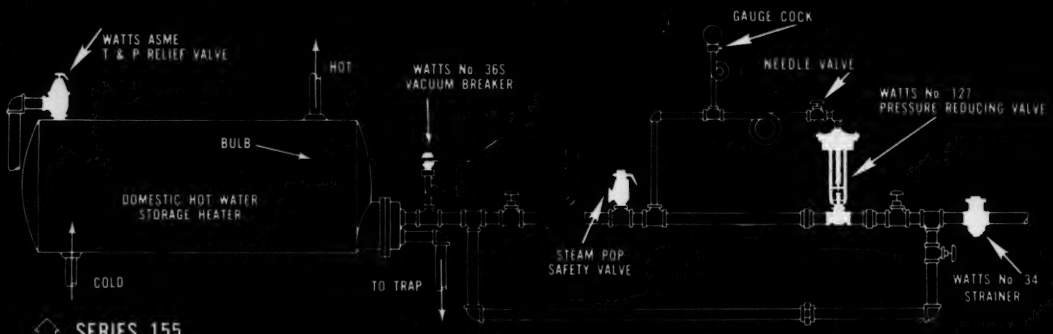

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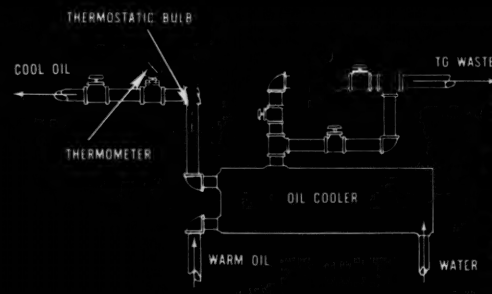

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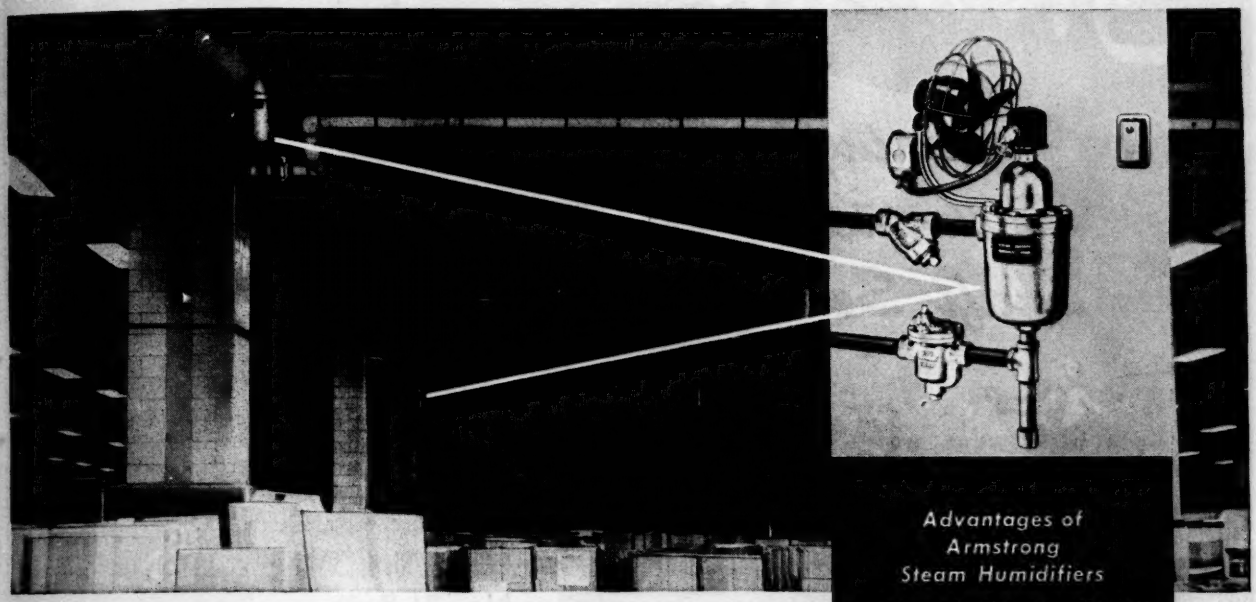

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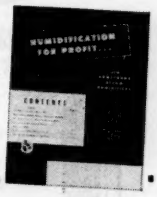
To get your copy, just send the coupon, or call your local Armstrong Representative today—there's no obligation.



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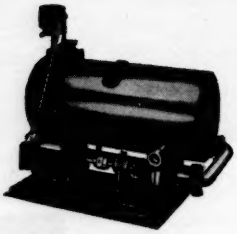

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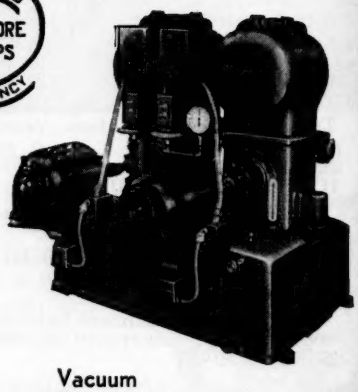

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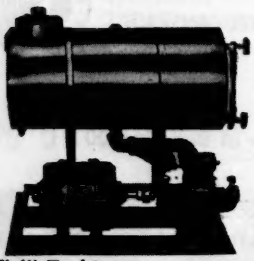

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AIR CONDITIONING HEATING AND VENTILATING

Volume 55, Number 9 September, 1958

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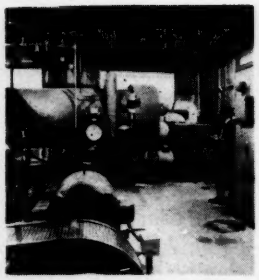

Refrigeration plant which serves a 85 by 200 ft outdoor ice skating rink at The Hotchkiss School, Lakeville, Conn. Photograph furnished by The National Supply Co., Pittsburgh, Pennsylvania.

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HIGH SPOTS

Manufacturers' shipments of compressor bodies during the first four months of 1958 continued at the level which marked earlier months of this year—about 25% under comparable shipments in 1957—it is reported by Air-Conditioning and Refrigeration Institute, Washington, D.C. Actual shipments for the first four months this year total 1,421,489 units, compared with 1,919,538 units in the same period of 1957. Shipments in the 30-hp and over class, however, were off only a negligible amount, from 2340 to 2314, in the same period.

A survey of 93,000,000 sq ft of major Manhattan, New York City, office space in 433 existing structures and buildings under construction reveals that air conditioned space is passing the 50% mark. The survey, made by Frank Hudik, president of Hudik-Ross Company, mechanical contractors, covers 12,178,000 sq ft of space in twenty new buildings under construction; 25,530,000 sq ft in ninety completed postwar buildings; and 55,303,000 sq ft of major space in 323 prewar buildings. Major office space, according to the Real Estate Board of New York, represents 83.5% of the total assessed value of all office buildings in Manhattan. The study showed that when the twenty buildings now under construction are completed, 51% of major office space in Manhattan will be air conditioned. A breakdown of the air conditioned space, which comprises nearly 48,000,000 out of 93,000,000 sq ft surveyed, includes the nearly 38,000,000 sq ft in postwar-completed and underway buildings, and approximately 10,000,000 sq ft of cooled space in prewar structures.

The Hudik-Ross study tallied with a New York Times report of a record peak in the demand for electricity in the five boroughs of New York City and adjoining Westchester County. Between 3 and 4 pm on July 16, customers of Consolidated Edison Company used 3,475,000 kw, and a total of 60,513,600 kwh for the day. The day's temperature ranged from 72 to 85.5 deg F; humidity, from 56 to 84%. The previous record had been set, the Times says, in the summer of 1957. Winter peaks are a thing of the past. Air conditioning in the company's territory requires over 850,000 kw, or about one fourth of its 3,700,000-kw capacity.

Program of the 52nd Annual Meeting of The American Society of Sanitary Engineering, on the 21st through 26th of this month at Atlantic City, N. J., includes a two-day Refresher Course including half-hour talks on the following topics: piping protection; principles of sewage treatment; principles of water filtration; plumbers' brass and tubing; swimming pools; cold water and sanitation; plastic pipe; non-metallic dip tubes; cast aluminum plumbing fixtures; vending equipment; trailer and trailer park sanitation; aerobic sewage treatment; ample water supply pipe size; copper plumbing; evaluation of surfaces in dishwasher; separators; economy of copper drain installation; and stainless steel fixtures.

A small analogue computer, designed to meet the needs of electrical, mechanical, and civil engineers, as well as physicists in research and development laboratories and educational establishments, will be shown at the SBAC Air Show, Farnborogh, Hants, England, this month. Called the Minispace, it is contained in a cabinet 51 inches high, 20 inches wide, and 30 inches deep. Described as a precise desk-side or laboratory tool which will solve many of the day-to-day problems of scientists, engineers, and designers, it will solve two simultaneous second or third order differential equations; one equation of the fourth or fifth order; problems in network analysis, resonant circuits with variable damping, servo systems; etc. Price is £1500 at the plant of The Solartron Electronic Group, Ltd., Thames Ditton, Surrey.

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WASHINGTON OVERTONES

by LORING F. OVERMAN

● Almost overnight, official Washington has reversed its thinking insofar as it concerns the national economy. Today's overtones deal with ways to forestall further inflation. Yesterday, how to brake a recession was the principal tone.

As always, Washington's first thought is: "There ought to be a law".

Senator Richard Neuberger (D-Ore.) was ready quickly with two suggestions:

Senate bill (S 4238) would give the President standby authority to place prices, wages and rents under ceilings for a period of 90 days under stated conditions. While passage of the measure was not anticipated at the 85th Congress, mere introduction of the measure serves notice that the nation is only hours away from economic controls if Congress were disposed to grant such authority.

Senate Bill (S 4239), also introduced by Senator Neuberger, would bring the earlier excess profits tax act up to date by changing from the Internal Revenue Code of 1939 to provisions of the new Internal Revenue Code.

In introducing the bills, Senator Neuberger warned that inflation is again becoming a threat. "I believe," he said, "standby controls should be available to the President to meet the needs of economic stability in our nation."

● How the President feels about inflation was related to newsmen at a press conference on the day of Senator Neuberger's introduction of his standby control bills.

"In the light of the rise in steel prices and the prospects for large federal deficits in the next five years, do you have any plans to curb inflation?" the President was asked.

"Strangely enough," the President replied, "you were hearing me talk about this problem of inflation a few months back when everybody wanted to spend more money and to decrease taxes."

The President then went on to explain that if the nation is to avoid economic controls, labor must avoid pushing wages up faster than productivity, and business must not raise prices too high.

"Because if they do," he continued, "just as sure as you are a foot high, one day the American consumer is going to rebel in a big way, and there will be real trouble, and we will get something we don't want."

● Controls are known to be displeasing to the President and his advisers. Nevertheless, Washington is seriously considering inflation brakes which would have seemed ridiculous a few months ago.

Among them are direct credit controls, as distinguished from regulation of the overall money supply. Also discussed are limitations on installment and home-buying credit—controls of the type previously imposed during hostilities.

Most difficult problem of the stabilization planners is the fact that the signs of inflation precede the fact, possibly by many months. Thus with winter ahead and millions still unemployed, great skill is required to keep the economy under control while at the same time keeping up all reasonable forward motion.

● A further effort to keep small business on an even keel is represented by passage of the Small Business Investment Act (S 3651), awaiting the President's signature at press time for this column.

The bill is designed to make long-term equity capital available to small business. Also provided for are loans to state and local development companies and federal grants for studies, research and counseling relating to management, financing and operating of small business establishments.

● Small business came in for another special mention in the huge appropriations bill providing nearly $40-billion for the Defense Department for the 1959 fiscal

(Continued on page 8)

Metals are the Best Insulators

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The surfaces of ordinary IRON have about 4 times the reflectivity against heat rays that the surfaces of asbestos, asphalt, paper, brick, plaster, wood and other ordinary building materials have. Brass, gold, silver and ALUMINUM surfaces have about TEN TIMES the reflectivity against heat rays that non-metallic materials have. Aluminum surfaces, for example, have a 97% reflectivity for RADIATION, whereas the surfaces of most building materials have a reflectivity of only 10%.

RADIATION (heat rays) is responsible for 65% to 80% of all heat flow sideways in building spaces; 55% to 75% upwards; 93% down.

Air space has low density, therefore heat flow by CONDUCTION through the **spaces** inside building walls, roofs, attics or floors is slight. CONVECTION accounts for 15% to 30% of the heat flow sideways in such spaces, and up to 45% upwards. There is NO convection down.

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Its continuous metal layers, up to 750 feet long, have almost zero permeability to vapor. Infiltration under flat stapled flanges is slight. Condensation formation on or within this type of insulation is minimized by its scientific construction. More than 400 million sq. ft. are in use today, a large part of it re-orders.

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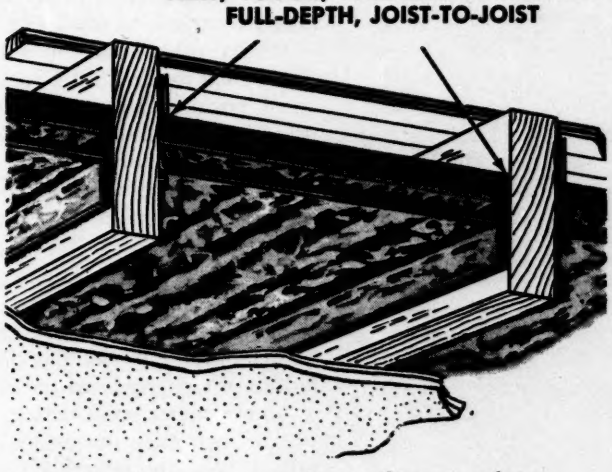

formation, it is necessary to use the new **edge-to-edge** multiple aluminum, **each** sheet of which stretches from joist to joist.

You'll enjoy, as well as profit from reading Alexander Schwartz's recently published manual: "Heat Flow by Radiation in Buildings, Simplified Physics." The scientific background of heat flow, specific information on how to control it, data on the various types of multiple aluminum insulation, ratings of insulation performance, and installation techniques under many conditions are interestingly discussed in this liberally illustrated 48 page manual. A FREE copy is yours for the asking.

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TYPE 6	C .068=4⅓"	C .034=9¾"	7¢ sq. ft.
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WASHINGTON OVERTONES *(Continued from page 6)*

year. In distributing the huge sum, largest military budget in peacetime, Congress directs the Defense Department "to award a much higher percentage of their prime contracts to small business concerns."

Several other efforts to aid small business, some of them unlikely to see favorable action in the 85th Congress, were also proposed. One, (S 3224) would assist small business concerns to obtain contracts for government purchases. Major provisions increase from $1,000 to $2,500 the amount which may be negotiated locally; make more uniform the procurement procedures to military and civilian agencies; and increase the power of contracting officers to make advances and progress payments to small concerns.

● Because of the vast amount of air conditioning equipment that would be involved, a recent report on bombing shelter programs should be of interest.

Released by the House Government Operations Committee, the report (of a subcommittee) warns that the nation is placed in "mortal danger" because of the failure of Congress and the administration to initiate a $20-billion dollar program of bomb shelter construction.

The committee renewed its plea, first made some four years ago, that the $22-billion program be started at once. The committee's report estimated that a hydrogen bomb attack on the 150 major cities of the United States would result in 160,000,000 casualties. The recommended bomb and fallout shelters, the committee said, should save all but 5,000,000.

● There's basis for the conclusion that home construction is one of the industries which has completed its recession cycle. New private dwellings put under construction in July totaled 107,000; a gain of 14% over July of 1957 and the largest private total for any month since May, 1955. The private home-building total was at the seasonally adjusted annual rate of 1,160,000 units, highest in two and one half years.

● In two recent actions, Washington has sought to "do something" for the coal industry and allied interests.

Through House Resolution (HR 9460) the House Interior Committee proposes establishment of a Coal Research and Development Commission. Such a commission, the Committee explains, would, if adequately financed, conduct programs which will substantially improve the economic condition of the coal mining industry at large, and prove highly beneficial to consumers of coal, to coal miners, to distressed mine areas, and to the general public.

Second action on behalf of the coal industry was the scheduling of a survey of heating costs at Fort Eustis, Va. The survey was scheduled in response to the National Coal Association's protests that there is "an apparently coordinated effort to convert most Government boiler rooms from coal to other fuels." The Fort Eustis survey was intended to provide a realistic yardstick involving fuel costs, and such related charges as storage, handling and firing procedures.

● Placing of contracts for 20 to 25-thousand additional units of military housing between now and August 11 of 1959 is anticipated by the Department of Defense. More than 58,700 units have been contracted for since the program was launched on August 11, 1955, with 11,780 units completed.

● The United States or one of its democratic allies could achieve "a major victory" by being the first nation to offer cheap and practical methods of de-salting water to the uncommitted and newly developing areas of the world.

So says the Interior Department's Office of Saline Water. A report issued by the House Government Operations Committee calls for greater emphasis on the research program to develop an economical means of converting saline water to fresh water.

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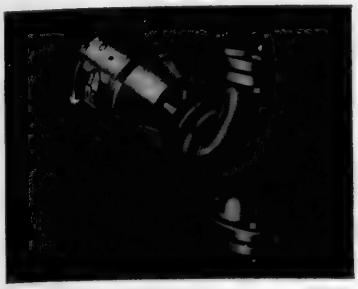
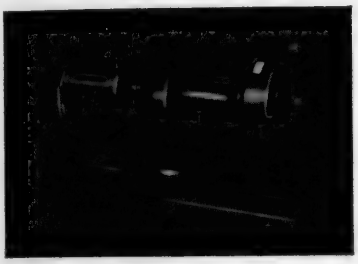
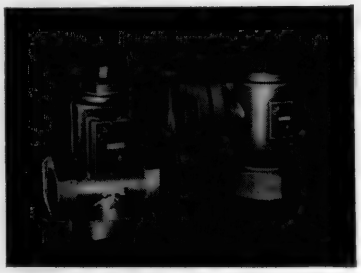


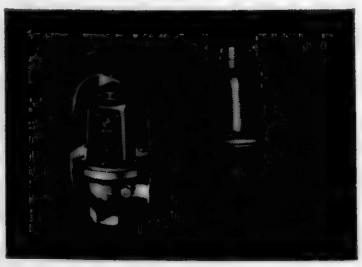
B&G Boosters



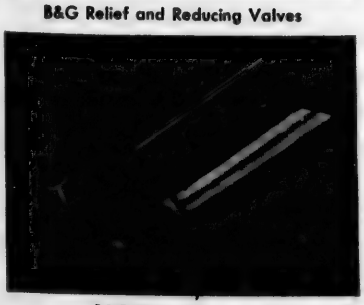
B&G Universal Pumps



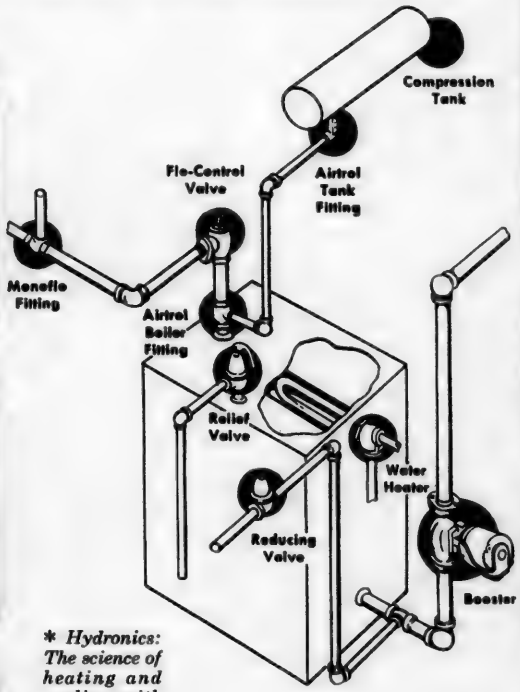
B&G Flo Controls



B&G Relief and Reducing Valves



B&G Airtrol Systems



* *Hydronics: The science of heating and cooling with water.*

The B&G emblem has become known as a symbol of quality...a natural result of continuous effort to improve product and service.

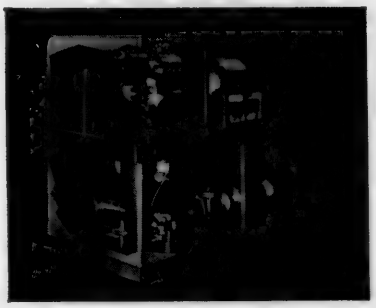
B&G *Hydro-Flo* Products for hydronic systems measure up completely to the standards by which every intelligent dealer judges the equipment he recommends and sells, namely, *good product, adequate service facilities, manufacturing responsibility and consumer acceptance!*

A circulated water system, for heating and cooling, when equipped with B&G *Hydro-Flo* Products throughout, offers all the advantages of a completely integrated installation of highest quality equipment, carrying a single manufacturer's guarantee.

B&G Monoflo Fittings

B&G Indirect Water Heaters

B&G Compression Tanks



B&G Package Liquid Coolers

B&G Condensing Units

Reg. U.S. Pat. Off.

BELL & GOSSETT
COMPANY

Dept. FK-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

BRIEFLY STATED

ENGINEERING SOCIETY NEWS

The 65th Annual Meeting of the American Society of Heating and Air-Conditioning Engineers and the 14th International Heating and Air-Conditioning Exposition under the auspices of ASHAE will be held in Philadelphia, Pa., January 26-29, 1959. Registration headquarters of ASHAE will be at the Bellevue-Stratford Hotel. The Exposition will be held in Convention Hall. Prior to the opening of the 65th Annual Meeting and the Exposition on Monday, January 26, the Council and various committees will hold meetings on Saturday and Sunday, January 24 and 25, 1959.

The Annual Meeting will consist of seven sessions including three symposiums and one topical session. The topical session will consist of papers concerned with human comfort as related to indoor environment. One of the symposiums will be on the general subject of hydronics, the other one on heat-pump performance, and the third symposium will be on corrosion and water treatment. An advance program and hotel reservations form have been sent to all members of the Society. The Committee on Arrangements recommends that reservations be made early to secure the accommodations desired. As heretofore, management of the Exposition will be provided by International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

AMONG THE ENGINEERS

DR. JOSEPH M. DALLAVALLE, Professor of Chemical Engineering at Georgia Institute of Technology, died June 1. He was well known in this field for his work on industrial exhaust hoods, research on which was performed while Dr. DallaValle was with the U. S. Public Health Service. Much of this material was later incorporated in a book, *Exhaust Hoods*, which appeared serially in this magazine and later in book form. He was also the author of a book, *Micromeritics*, dealing with the science of fine particles . . .

JOHN L. ALDEN, 72 Durand Road, Maplewood, N. J., is offering a consulting service in the field of industrial exhaust work to makers and users of dust and fume collecting systems, pneumatic conveying systems, gas scrubbers, cyclones, and other devices for collection of contaminants. He is the author of *Design of Industrial Exhaust Systems*, a product of experience dating back to 1914, including association with Western Electric Company. He will continue as president of Simplex Equipment Corp., subsidiary of General Precision Equipment Corp., Bloomfield, N. J. . . .

MARC RESEK, 3210 Warrenville Center Rd, Shaker Heights, Ohio, announces that he is resigning his post as vice-president of Perfection Industries Division of Hupp Corporation to enter a consulting practice. He will render service in the design of new products; in analysis of product lines; in studies of markets; in studies of patent situations; in organization of engineering and research departments; and in analysis of plant operations . . .

J. B. SHIPP AND ASSOCIATES, CONSULTING ENGINEERS, announce the opening of new offices in the Kaufman Building, Lake Charles, La. They are prepared to serve industry, private clients, architects, and other engineering firms in the field of electrical and mechanical engineering practice . . .

H. E. BOVAY, JR., CONSULTING ENGINEERS, announces the following organizational changes: Bennett W. Burns, partner, will assume the duties of managing partner at the home office, Houston 4, Tex. S. J. Bell, associate, will take up Mr. Burns' former duties as chief engineer, Houston. Guy Furgiuele, associate, will become assistant chief engineer, Houston. L. S. Curtis will be made an associate of the firm and assistant to Mr. Bovay. In addition to engineering assignments, he will assist in overall coordination and direction of the organization's nationwide activities. Morris Backer will succeed Mr. Furgiuele as head of the air conditioning and plumbing design divisions.

AMONG THE ASSOCIATIONS AND INSTITUTES

William H. Scheick has resigned as executive director of BUILDING RESEARCH INSTITUTE (BRI) and the BUILDING RESEARCH ADVISORY BOARD (BRAB) effective on the fifteenth of this month. He will take a position as vice-president of research and development for Timber Engineering Company. No successor has been appointed yet. William Gillett, vice-president of Fenestra, Inc., has been appointed chairman of BRAB . . .

The Dynamics of Distribution has been chosen as the theme for the 37th annual convention of the PRODUCERS' COUNCIL, INC., Washington, D. C. Its meeting will be held in Miami, Fla., September 17-19 at the Dupont Plaza Hotel. The whole broad topic of the distribution process—marketing research, sales promotion, and advertising—will be explored . . .

Adolph O. Schaefer, president, Pencoyd Steel and Forge Corp., Philadelphia, Pa., has accepted appointment to the unexpired term of secretary of the AMERICAN SOCIETY FOR METALS, Cleveland, Ohio, following the recent death of founder-member William H. Eisenman, who for forty years was national secretary.

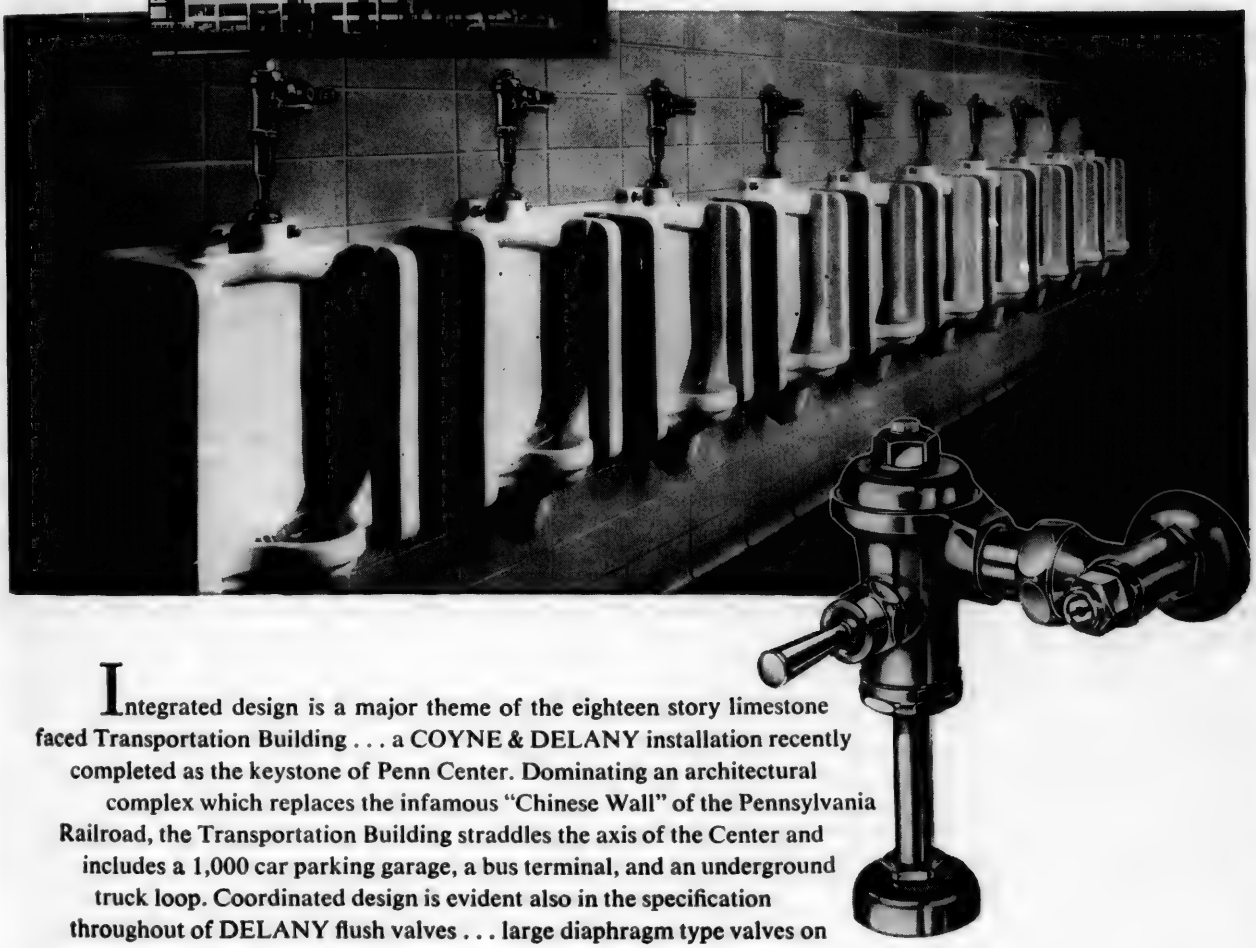
PATENT OFFICE EXHIBIT

BARBER-COLEMAN CO., ROCKFORD, ILL., was one of 15 well known American firms who participated in a mechanical exhibit at the Patent Office, Washington, D. C., that showed the technological advances and contributions to the nation's industrial development made possible under the American patent system. The Barber-Coleman exhibit depicted the growth of the company from a small manufacturer of hand knotting equipment to a major producer of textile machinery, machine tools, aircraft controls, electrical components, industrial instruments, and air conditioning controls and air distribution devices. A brochure distributed at the exhibit describes how 18-year-old Howard D. Coleman obtained a loan of one hundred dollars from lumberman W. A. Barber to finance his hand knotting invention, an arrangement that led to patent No. 672,636 and to the founding of the company.

(Concluded on page 12)

And in Philadelphia – A FUTURE OF FAULTLESS SERVICE

TRANSPORTATION BUILDING
PENN CENTER
Philadelphia, Pa.
McCLOSKEY & CO.
owner and builder
VINCENT G. KLING
architect
ROBERT J. SIGEL, INC.
mechanical engineer
AMBROSE-AUGUSTERFER CORP.
plumbing contractor
B. H. DEACON CO., INC.
wholesale distributor
AMERICAN RADIATOR & STANDARD SANITARY CORP.
plumbing fixtures manufacturer



Integrated design is a major theme of the eighteen story limestone faced Transportation Building . . . a COYNE & DELANY installation recently completed as the keystone of Penn Center. Dominating an architectural complex which replaces the infamous "Chinese Wall" of the Pennsylvania Railroad, the Transportation Building straddles the axis of the Center and includes a 1,000 car parking garage, a bus terminal, and an underground truck loop. Coordinated design is evident also in the specification throughout of DELANY flush valves . . . large diaphragm type valves on water closets and smaller diaphragm type valves to coordinate with urinals . . . a visual plus available only from DELANY— "the fastest growing name in flush valves!"

DELANY *Flush* VALVES

Since 1879

DELANY . . . THE ONLY COMPLETELY DIAPHRAGM-OPERATED LINE OF NATIONALLY DISTRIBUTED FLUSH VALVES

All Delany Flush Valves give the quality of diaphragm operation that others only offer in their "premium" valves. Durable, longer-lasting chrome tanned leather diaphragms in Delany Flush Valves operate best in water service . . . provide "life-of-building" performance. Decide on Delany . . . Fastest Growing Flush Valve Line!

COYNE & DELANY CO. • 834 KENT AVE. • BROOKLYN, NEW YORK

IN CANADA: THE JAMES ROBERTSON CO. LTD.

BRIEFLY STATED

(Concluded from page 10)

BURGEONING BUSINESS

Detailed plans for a $750,000 addition to the 25th Street plant of Herman Nelson Division, in Moline, Ill., is revealed by American Air Filter Co., Inc. The new structure will contain 76,800 sq ft of floor space and will increase the present facilities by approximately 50%. Consolidation under one roof of parts now scattered in buildings throughout a ten-mile section of the Quad-Cities (Moline, East Moline, Rock Island, Davenport) is the company's most immediate goal. Occupancy is expected before the 1959 summer peak load . . .

An industrial expansion program has been initiated by CLEAVER-BROOKS CO., Milwaukee, Wis. Included are a 70,000 sq ft addition to the firm's Lebanon, Pa., eastern manufacturing center and a new 25,000 sq ft production facility at Stratford, Ontario, Canada. The Lebanon expansion will more than double the production space of the plant set up two years ago and is expected to be ready by December, 1958. The Stratford plant, to be erected on ten acres within the city limits, is slated for occupancy late this year with initial production scheduled for early 1959 . . .

The following firms have been appointed authorized sources for packaged equipment manufactured by THE TRANE CO., LaCrosse, Wis.: Uniflow Company of Boston and G. E. Steele Company, Roxbury, Mass.; John Bright & Associates, Inc., San Angelo, Tex.; Tonn & Blank, Inc., Michigan City, Ind.; Pons & Davis, Salt Lake City, Utah; Barrett Heating & Air Conditioning, Bayshore, L. I., N. Y.; North Shore Heating and Cooling, Inc.; Syosset, L. I., N. Y.; Spencer's Electric and Plumbing Company, Leaksville, N. C.; and Bridges & Jarrell, Inc., St. Louis, Mo. . . . ILG ELECTRIC VENTILATING CO., Chicago, Ill., announces appointment of John M. Dooley as the company's Knoxville representative for its complete line. A manufacturer's representative since 1950, he has been associated with the Knoxville Utilities Board for many years as rate and electrical engineer . . . Exclusive sales agent in its territory for bronze and iron body valves manufactured by THE FAIRBANKS CO., New York, N. Y., Henry H. Paris Distributor, Inc., will cover the states of Texas, Oklahoma, and Arkansas.

WITH THE MANUFACTURERS' PERSONNEL

The first to complete the company's four-year scholarship program at California State Polytechnic College, San Luis Obispo, Cal., Norman Nichols has joined the permanent sales staff of DRAYER-HANSON DIV., NATIONAL-U.S. RADIATOR CORP., Los Angeles, as assistant sales engineer. The college is said to offer the only full four-year program in the country that leads to Bachelor of Science degree in Air Conditioning and Refrigeration . . . Appointment of J. Robert Lewis as vice-president in charge of engineered sales of WALTON LABORATORIES, Irvington, N. J., announced. He has been a vice-president with the company for eleven years, and will spearhead a technical information program to architects and engineers on controlled humidification with the company's equipment . . .

SPORLAN VALVE CO., St. Louis, Mo., announces appointment of Jack E. Dannels to the post of sales manager, OEM accounts, a newly created post . . .

Donald H. Ninow has been named manager of the Moline, Illinois, branch office for AMERICAN AIR FILTER CO., INC., succeeding Frank Tyler who retired. Mr. Ninow, 37, a native of Chilton, Wisc., and a graduate of Alabama Polytechnic Institute, Auburn, Ala., with a degree in mechanical engineering, is president of the Illinois-Iowa Chapter, ASHAE. He also is a past president of the Quad-City Air Conditioning Society . . .

Walter H. Steitler, president of Carrier-Houston Corp., a wholly-owned distributorship at Houston, Tex., moves to CARRIER CORPORATION headquarters in Syracuse, N. Y., as assistant to the president. William C. Egan, sales manager of packaged equipment in the Unitary Equipment Div., transfers from Syracuse to Houston to succeed Mr. Steitler. A new post, that of director of project qualifications in the research and development division of the company, is filled by Elbridge Gammill. William H. Macdonald, who has been assistant manager of the machinery department headed by Mr. Gammill, advances to manager; Robert A. Riester, manager of the manufacturing engineering department, succeeds Mr. Macdonald; and Jay E. Endres, a member of the group formerly headed by Mr. Riester, has been named its manager. In his new position, Mr. Gammill reports to Dr. J. F. Downie Smith, vice-president in charge of the Research and Development Division, in evaluating research projects considered to have commercial potential . . .

Appointment of Christian J. Schurman as general sales manager, ENGINEERED MACHINERY DIV., YORK CORPORATION, subsidiary of Borg-Warner, was announced. Headquartered in York, Pa., he will direct the sale of all engineered York air conditioning and refrigerating equipment in this country. George C. Briley has been named district manager of the Southwest District of the company. His territory includes Texas, Louisiana, New Mexico, and part of Mississippi . . .

John Nash is appointed sales manager of PROGRESS AND MONITOR BOILER DIV., CLEAVER-BROOKS CO., Milwaukee, Wis. He succeeds Robert E. Sullivan, who will head the company's sales agency in the Cleveland territory . . . Charles W. Parker, formerly manager of the Philadelphia district of ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., fills the newly-created post of director of sales promotion in the company's Industries Division. Advertising, publications, and industrial press departments are under his jurisdiction . . . A product planning manager is assigned to each product class at DETROIT CONTROLS DIVISION OF AMERICAN-STANDARD, a new plan. F. Y. Carter supervises air conditioning controls; W. C. Dorr, appliance controls; J. F. Page, TyniSwitch products; R. W. Miller, bronze valves; and H. L. Walker, industrial controls . . . David H. McClain is appointed general manager of the branches of CRANE CO., Chicago, Ill. He will be responsible for the administration of the company's 131 branches in the United States.

Fedders capillary assemblies incorporating Anaconda restrictor tubes: *Left*, assembly serving the Fedders 3-hp packaged air conditioner; *center*, the 1-hp heat pump unit; *right*, the ¾-hp casement air conditioner, illustrated.

"We use Anaconda Restrictor Tube 100%" –Fedders-Quigan Corp.

As one of the largest producers of room air conditioners, Fedders-Quigan Corporation, Maspeth, Long Island, uses miles of restrictor tube a year. Since 1954, Fedders has been using only Anaconda Restrictor Tube.

Fedders looks on the restrictor tube as the jugular vein of the air conditioner. The faithful performance of the entire unit depends largely on the tube's uniformity and quality. Fedders looks for these qualities in restrictor tubes:

1. Uniform performance within extremely close air-flow limits, made possible by consistently uniform inside diameter and a smooth, round, clean bore.
2. Easy bending, without fractures.

Fedders uses restrictor tube in four inside diameters in six lengths, reordering from Master Sample Reference Tubes. Duplicate Master Reference Samples kept at French Small Tube Division, The American Brass Company, insure that all shipments have the air-flow limits originally established.

Consistently high quality. All Anaconda Restrictor Tubes are plug-drawn to finish. Every length is chamfered at both ends, inside and out. Each tube is thoroughly washed and dried, given a final air-flow test, carefully bundled, with ends of each bundle wrapped in paper. Anaconda Custom-Made Restrictor Tubes are made in both copper and aluminum, in nominal inside diameters from .025 to .090 inches.

Write for information or free Air-Flow Slide Rule Calculator. Address: French Small Tube Division, The American Brass Company, Box 1031, Waterbury 20, Conn.

ANACONDA®

RESTRICTOR TUBES

Made by French Small Tube Division of The American Brass Company

ANACONDA PRODUCTS FOR THE REFRIGERATION AND AIR-CONDITIONING INDUSTRY

Scientific Frontiers

Controlled Thermonuclear Reactions

The ultimate objective of the Atomic Energy Commission's program of controlled thermonuclear research is to develop means of producing useful power from the energy released in a nuclear fusion reaction, the process that generates the heat of the sun and stars, and gives the so-called hydrogen bomb its enormous power. During fiscal year 1958, $20-million is being spent on operating the program, initiated in 1951, and this amount will be doubled in 1959. An outline of the expected benefits of fusion power, as listed by the Commission in its book, *Research on Power from Fusion and other Major Activities in the Atomic Energy Programs*, indicates reasons for the heavy investment:

1. Fuel costs would be extremely low. At present, deuterium (heavy hydrogen) costs about $140 per lb to produce. If its nuclear energy content could be converted completely into electrical energy, one pound of deuterium could yield 40-million kw-hr of electricity. The gross fuel cost would be only 0.0035 mills per kw-hr.

2. Fuel supply would be virtually unlimited. Heavy hydrogen exists in all surface waters of the world; the total of this deuterium is estimated at 10^{17} lb. Complete fusion of this quantity of deuterium would produce 10^{21} kilowatt-years of electricity. Present U.S. consumption is at the rate of 72-million kw-years.

3. A fusion power plant would be safe. All calculations indicate that a nuclear explosion could not occur, and the risk of runaway or explosion appears to be about the same as for a conventional coal-fired power plant.

4. Radioactive hazards would be low. Radioactivity will be induced in the material surrounding the reactor, but the fusion reaction will not create large quantities of long-lived radioactive by-products that must be disposed of.

5. Plant efficiency may be high. A part of the energy released in fusion reactions in a power plant might be convertible directly into electricity without the loss of efficiency that occurs in heating a cooling agent and using the transferred heat to drive a turbo-generator. Heat processes would be needed to put to work the rest of the energy.

However, to harness nuclear fusion reactions for the production of power, three goals must be reached successively.

First, a fusionable material must be heated to the ignition temperature, the threshold temperature for a self-sustaining reaction. At this point, fusion enery is being released within the fusion fuel at a rate sufficient to offset the loss of energy from the fuel by radiation. For fusion fuels consisting of heavy hydrogens, this ignition temperature is at least 100-million deg C.

Second, after ignition temperatures have been achieved, a machine (a fusion reactor) must be designed that will produce an excess of power; that is, more power than is consumed in operating the machine.

Third, production of power from a fusion reactor must be made economically competitive with electricity produced by other means.

At present, the main effort of the program is directed toward achieving the first goal—ignition temperatures. The principal difficulties to be overcome in attaining these temperatures are as follows:

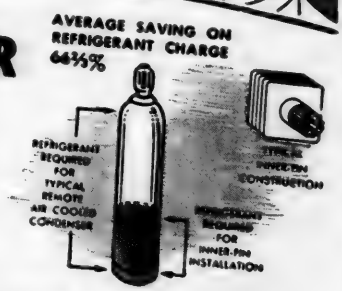
1. The temperatures required are exceedingly high and capable of vaporizing any material whatsoever.

2. The plasma, a body of ionized gas resulting from the heating of matter to very high temperatures, must be suitably confined, with adequate density.

While heating techniques employed in various fusion experiments differ from one type of device to another, it is generally agreed that magnetic fields provide the best means of confining a hot plasma.

What's NEW in Remote Air Cooled Condensers? *This*

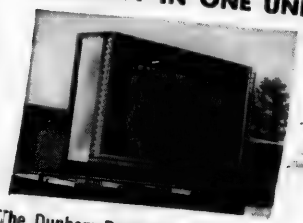
A REMOTE AIR COOLED CONDENSER THAT REQUIRES ONLY 1/3 OF THE REFRIGERANT CHARGE USED BY COMPETITIVE MODELS

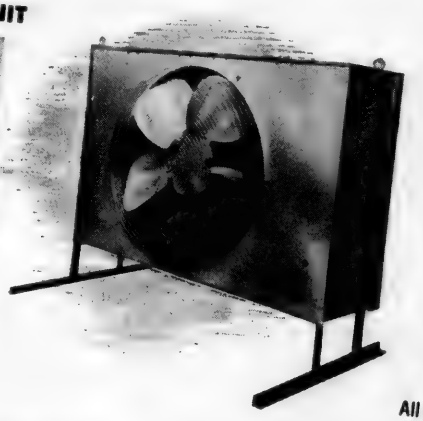

AVERAGE SAVING ON REFRIGERANT CHARGE 66⅔%
REFRIGERANT REQUIRED FOR TYPICAL REMOTE AIR COOLED CONDENSER
TYPICAL INNER-FIN CONSTRUCTION
REFRIGERANT REQUIRED FOR INNER-FIN INSTALLATION

A RECENT 300 TON JOB SHOWED SAVINGS OF 1800 LBS. OF REFRIGERANT THROUGH USE OF THESE UNITS.

Yes, the Dunham-Bush 'BC' Remote Air Cooled Condensers with famous Inner-Fin construction mean savings of 67% in refrigerant charge. Additionally, they mean smaller receivers and minimum loss if the system charge is lost. In these expertly planned units, the exclusive Inner-Fin construction diminishes the internal volume of the coil while increasing the heat transfer coefficient. And higher heat transfer factors permit design of more compact units, saving valuable space in installation.

AS MUCH AS 53.5 TON CAPACITY IN ONE UNIT





The Dunham-Bush line of 'BC' Remote Air Cooled Condensers includes models in 13 sizes with capacities ranging from 2.2 tons to 53.5 tons, making possible use of a single unit for practically any job!

FOR ALL 'ROUND PROTECTION

Plastic vinyl paint is applied to all ferrous parts of unit casing and structure in three stages:
PRIMER—a polyvinyl plastic combined with zinc chromate.
INTERMEDIATE—a vinyl resin with high lead content.
FINISH—hard grey, all weather resistant plastic vinyl.
All interior surfaces of the unit casing are given an extra finish coat of plastic vinyl.

AND FOR MAINTAINING SATISFACTORY HEAD PRESSURES

at all ambients, Dunham-Bush engineers offer the 'PS' Pressure Stabilizer.

'PS' units can be mounted indoors near the compressor, facilitating the making of necessary adjustments. They are thoroughly factory tested and assembled, and require connection only to the refrigerant liquid and discharge lines. No extra piping or special loops required. Regulating valve gives smooth pressure control and eliminates wide pressure fluctuations inherent in other head control systems.

The name Dunham-Bush is synonymous with efficient, satisfactory service for all types of pressure and temperature conditions. For technical assistance, our engineering staff is at your service. For more information, contact us.

Dunham-Bush, Inc.

DUNHAM-BUSH

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA • MARSHALLTOWN, IOWA • RIVERSIDE, CALIFORNIA • UTICA, NEW YORK

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heat-x HEAT-X, INC. BREWSTER, N.Y. · BRUNNER THE BRUNNER CO. GAINESVILLE, GA. · DUNHAM-BUSH (CANADA), LTD. TORONTO, CANADA · DUNHAM-BUSH, LTD. LONDON, ENGLAND · BRUNNER CORPORATION (CANADA) LTD. PORT HOPE, ONTARIO.

Know-how makes the

IN INSTALLATION AND SERVICE ENGINEERING

Dravo's new *Counterflo* is the only industrial space heater backed by a world-wide organization. The map gives you an idea of the number and location of the qualified heating engineers, sales and service offices, representatives and foreign licensees who form this global network.

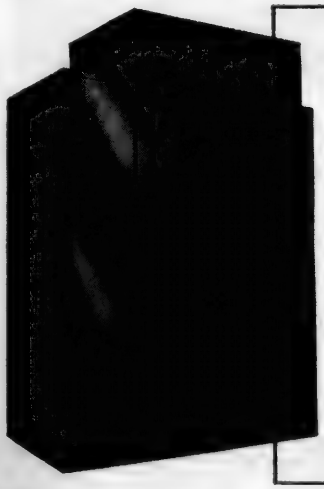
This means that a *Counterflo* owner not only has outstanding heater performance, but also a highly trained, factory-schooled service organization on 24-hour call. Should the need arise, service, for both installation and maintenance, is as close as your telephone. Dravo's wide-spread field activity is supplemented by the Pittsburgh staff, who stand ready to fly to any part of the country immediately.

This is just one of the many outstanding benefits available with your new *Counterflo*. For more information, write for Bulletin 564. Address DRAVO CORPORATION, DRAVO BUILDING, PITTSBURGH 22, PA.

DRAVO

CORPORATION

difference



5 REASONS WHY THE DRAVO COUNTERFLO IS YOUR BEST SPACE HEATER BUY

NEW PYROJET BURNER—exclusively Dravo—first burner developed specifically for direct-fired space heaters. Burns low cost oils efficiently. Switches from gas to light oil automatically.

NEW INDUCED DRAFT FIRING—automatically controls fuel/combustion air ratio, high negative pressure in combustion chamber adds extra safety; extra efficiency because of complete control of combustion air.

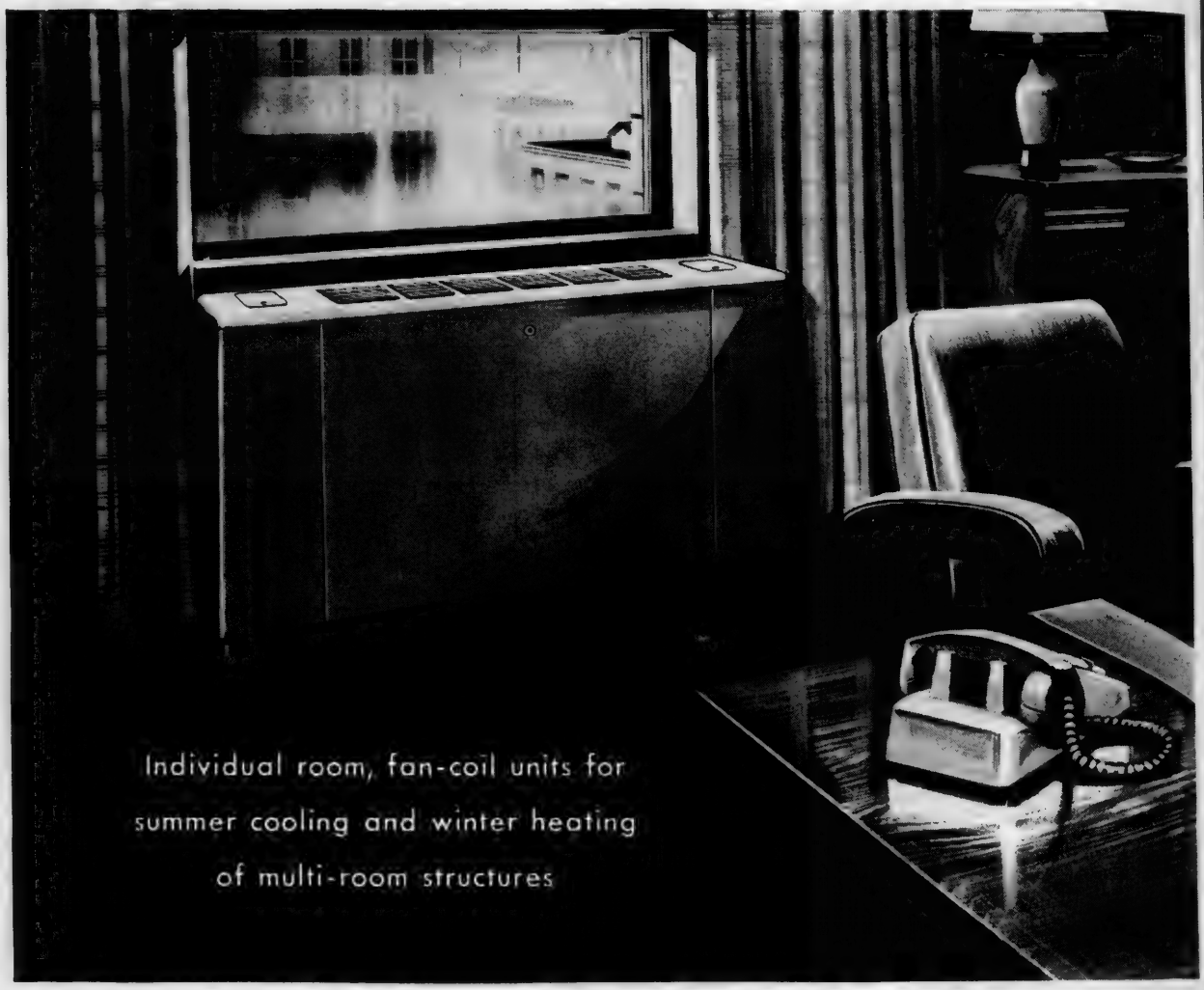
NEW AIRFOIL COMBUSTION CHAMBER—stainless steel, ribbed for extra strength and channeling of airflow—guaranteed for 10 years. Longest possible flame travel for complete combustion within primary heat transfer area.

NEW LOW-SPEED FANS—forwardly curved, low-speed, double inlet fans with high efficiency reduce horsepower requirements in the new Counterflo drastically, operating costs are lower.

NEW DISCHARGE PLENUM—distributes heated air at high velocity without annoying drafts. Adds new flexibility to warm air distribution patterns.

ALL NEW AMERICAN

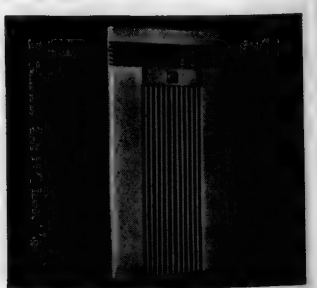
FAN-COIL-TYPE



Individual room, fan-coil units for summer cooling and winter heating of multi-room structures

Tonrac® Centrifugal Refrigeration Machines maintain constant chilled-water temperature regardless of load. Advanced design, quiet operation.

Type AB Multi-Zone Unit. Single arrangement provides either vertical or horizontal blow. Designed for either low-pressure or high-pressure systems.



American Blower Packaged Air Conditioners. Sizes from 3 to 20 tons. Air- or water-cooled models for use with or without ductwork.

BLOWER DIAFLO®

UNIT AIR CONDITIONERS

Diaflo units are designed, engineered, and manufactured to meet the professional requirements of each member of the building team

Architect

"They provide the design flexibility and pleasing appearance an architect likes in a unit air conditioner. They adapt readily to both new and existing buildings, with a choice of lengths to fit modularly spaced partitions. Diaflo units are completely suitable for new curtain-wall-type buildings or for other types of construction."

Consulting Engineer

"They're versatile mechanically, too, with rugged, heavy-gauge construction. Two basic units permit either vertical or horizontal installation. Front or top discharge is available on vertical unit. Universal coil permits summer cooling with chilled water, and winter heating with hot water. Coil is suitable for manual, electrical, or pneumatic control."

Mechanical Contractor

"Diaflo units provide a really 'clean' installation. Base unit is easily mounted with free access on both ends for all connections. Installer can work freely without being cramped. This saves time and money. Then just prior to start-up, clean, undamaged enclosure can be hung in place."

Owner

"Diaflo units certainly fit the requirements of modern building air conditioning. They harmonize well with practically any interior decor—are quiet, draft-free, and permit room occupants to select their own temperature. Maintenance is economical, too. Filter removal is easy, and there is ready access to all controls."

You can pinpoint responsibility for equipment performance, delivery dates, user satisfaction on any air-conditioning system you plan by using American Blower equipment . . . the complete line that's designed, engineered, and manufactured to work together.

And 73 branch offices offer local product help or nation-wide sales-service coordination. American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

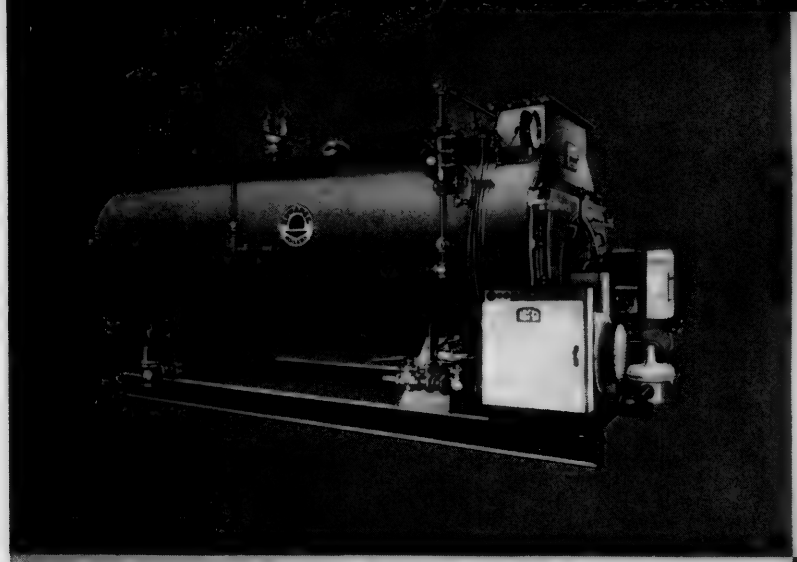
* American-Standard and Standard ● are trademarks of American Radiator & Standard Sanitary Corporation.

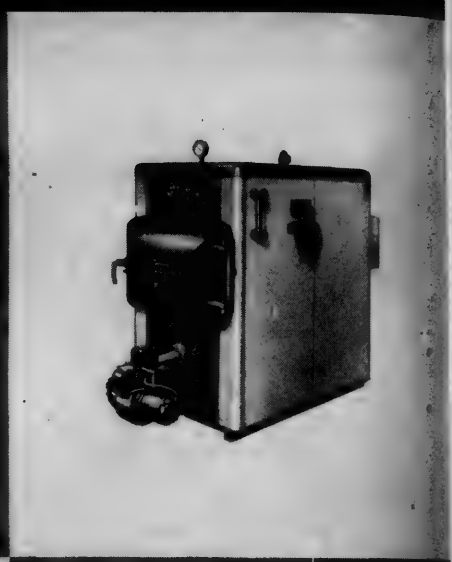
AMERICAN-Standard

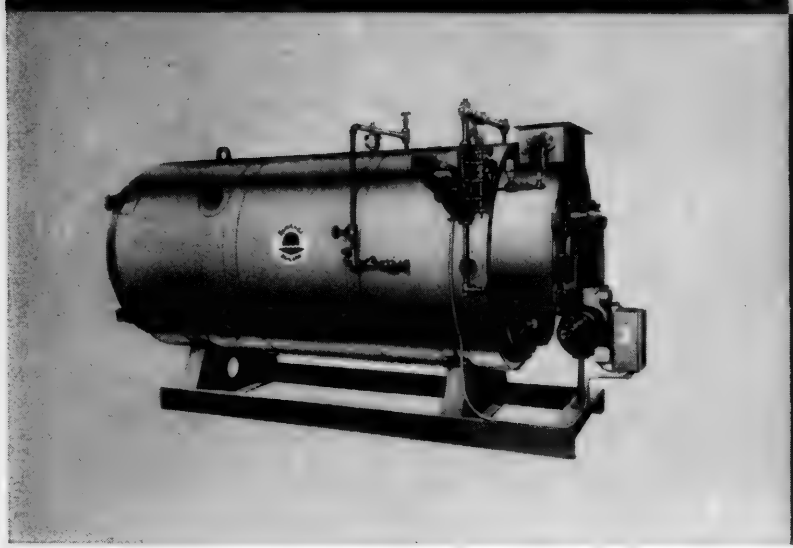
AMERICAN BLOWER DIVISION

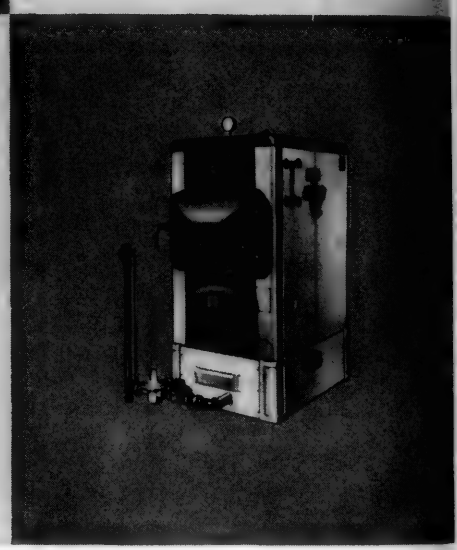
KEWANEE® PACKAGES

36 sizes span a full range of fuels









Now Kewanee's family of integrated boiler-burner packages covers a spread of sizes from 18 to 651 hp in high pressure models . . . 216,000 to 21,855,000 Btuh, low pressure. The fuel range is all-inclusive, too—oil from No. 1 through No. 6 . . . natural, manufactured, mixed or LP gas . . . oil-gas combination firing on any Scotch type package . . . forced draft eliminates high stacks. Factory assembling and fire-testing on Scotch type packages, when desired, means only five simple connections for installation. For complete facts on any type, any size or any fuel, contact your nearby Kewanee Man. AMERICAN-STANDARD, KEWANEE BOILER DIVISION, 117 Franklin Street, Kewanee, Illinois.

AMERICAN-Standard

KEWANEE BOILER DIVISION

ANNOUNCING

Die-Stamped "LAMINAIR-FLO"

Two-piece 90° Elbows

MACHINE MADE
MASS PRODUCED

A NEW SMOOTHER PATH FOR HOT OR COLD AIR

Ideal For High Velocity Systems

- Reduced Static Head Loss
- Cold Forged In Precision Dies
- True Radii
- No Variations in Workmanship
- Uniform Consistent Data

A remarkable new concept in 90° elbows. Precision engineered, die-formed, longitudinal seam, two-piece elbows reduce friction loss considerably . . . systems are far more efficient. Production-line manufacturing reduces fabrication costs . . . elbows and fittings can be specified with a guaranteed uniform size and performance.

Complete Range of Uniform Size, Die-Stamped Elbows In 3", 4", 5", 6", 7", 8" Diameters

Write To Division 89 For Price Information, Friction Loss Chart And New Engineering Test Data

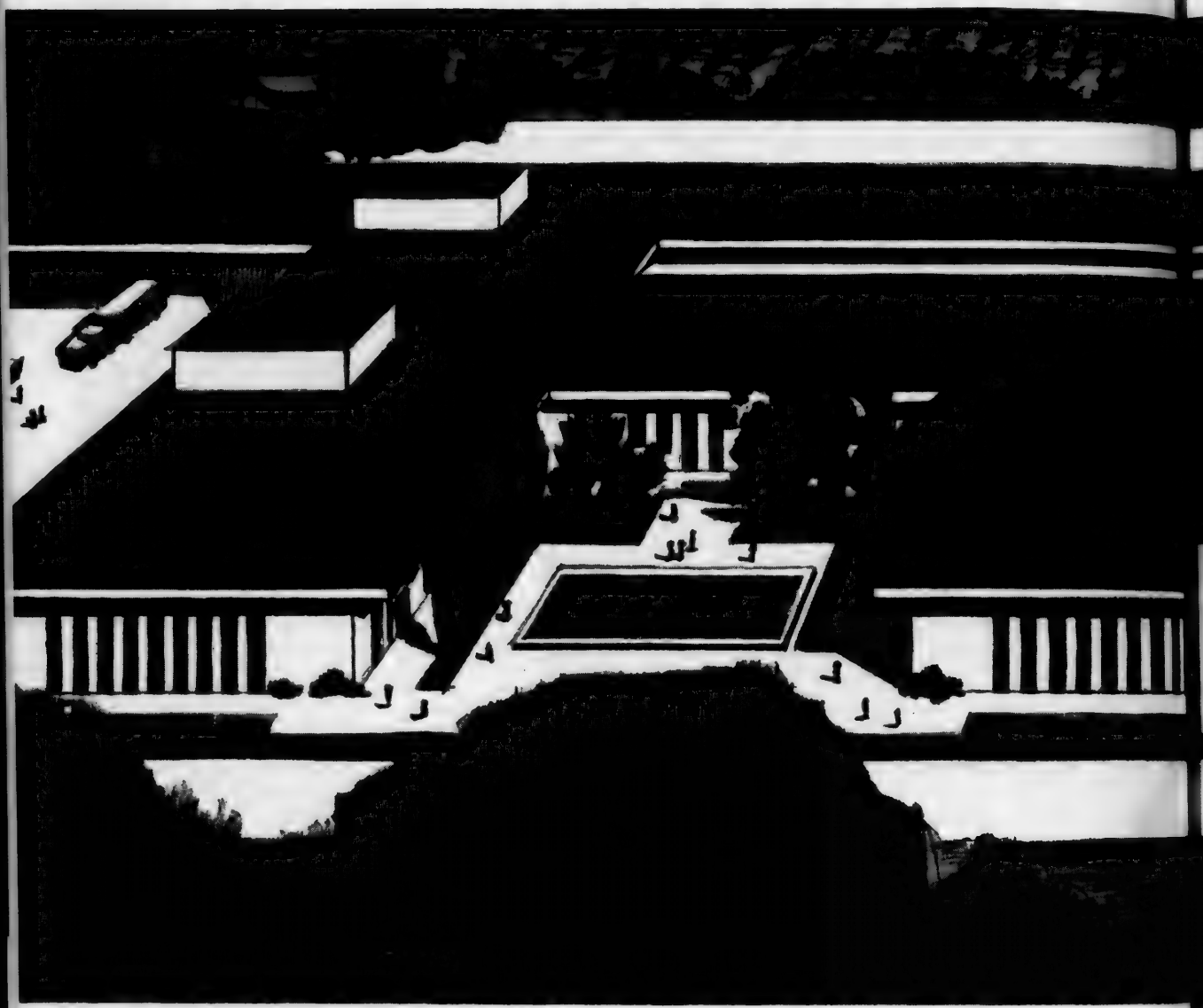
Another Advanced Design Product From

UNITED
SHEET METAL CO., INC.

Representatives In Principal Cities In United States and Canada

, COLUMBUS 9, OHIO

...NOW WE'RE



Specify Arkla-Servel Gas Air Conditioning and you specify years of trouble-free comfort

With the new Arkla-Servel Gas Absorptive Cooler, your clients will get extra—even exclusive—advantages that they'll get *only* with a gas cooling system.

Only gas gives these important advantages:

. . . High efficiency at *all* times—even during the light loads.

. . . Constant temperature control.

. . . Modular adjustment of capacity (instant automatic adjustment to match actual cooling requirements).

. . . Dependability of fuel service at all times.

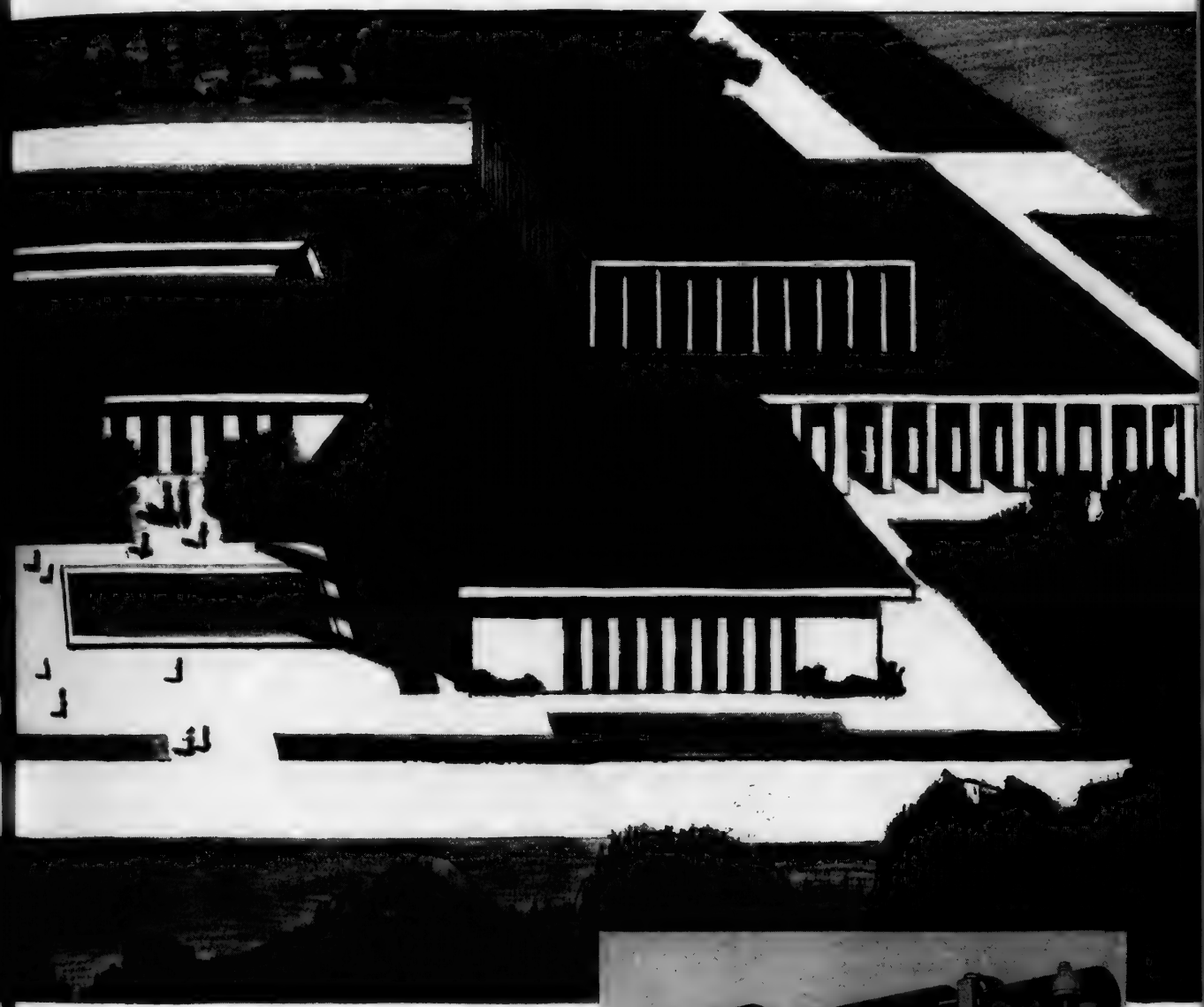
The 25-Ton Arkla-Servel Cooler

. . . A compact unit, easy to install and light enough for rooftop installation.

. . . Costs are low for installation, operation and maintenance. No specially trained operating or maintenance personnel are required.

. . . Can be installed singly or in banks to fit any size installation.

COOLING WITH GAS



Gas absorptive cooling can put your commercial and industrial clients' heating plant on a year around paying basis. It utilizes low pressure steam to cool water, has no moving parts to wear out, and provides quiet, economical operation. What's more, it's *vibration-free*.

Take advantage of the consulting free services provided for you by your gas company. They have trained specialists who have been working with contractors and builders for years. They belong to your associations or affiliations and are familiar with your problems. Check the facts about gas and you'll see—modern gas air conditioning out-performs all other fuels. *American Gas Association.*

New Beauty on Cleveland's Skyline

Got lifetime service valves and got them fast by choosing JENKINS

More than top quality in valves was required for this $17,000,000 aluminum-and-glass building, completed in April 1958 to provide offices for the Cleveland Electric Illuminating Company and other industrial and commercial tenants. In addition to valves that would last for the building's lifetime, the builders sought assurance that a close delivery date would be met.

Both were assured by the choice of Jenkins Valves for all plumbing, heating and air conditioning lines.

For almost a century the name JENKINS has meant enduring quality. Jenkins Valves in service for fifty years and good for many more are often reported.

And, when valves are needed quickly, Jenkins' efficient, national system of distribution can't be surpassed. Jenkins Bros., 100 Park Avenue, New York 17.

Architects:
Carson and Lundin, New York

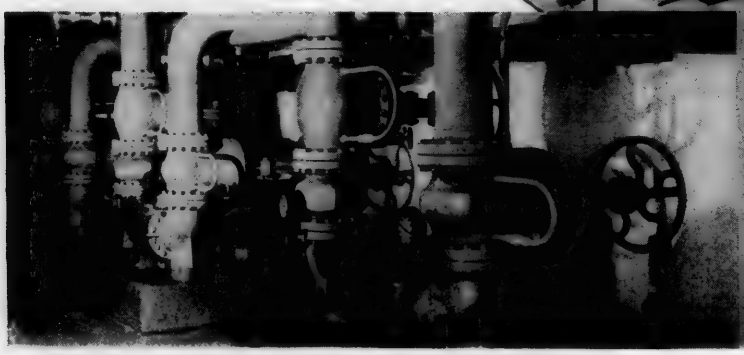
Consulting Engineers:
Jaros, Baum & Bolles, New York;
McGeorge, Hargett and Associates, Cleveland

General Contractor:
George A. Fuller Company, New York

Heating-Air Conditioning Contractors:
Kerby Saunders Company, New York;
Feldman Brothers Company, Cleveland

Plumbing Contractors:
Kerby Saunders Company, New York;
Gorman Lavelle Plumbing-Heating Co., Cleveland

Managing Agents:
Ostendorf-Morris Company, Cleveland

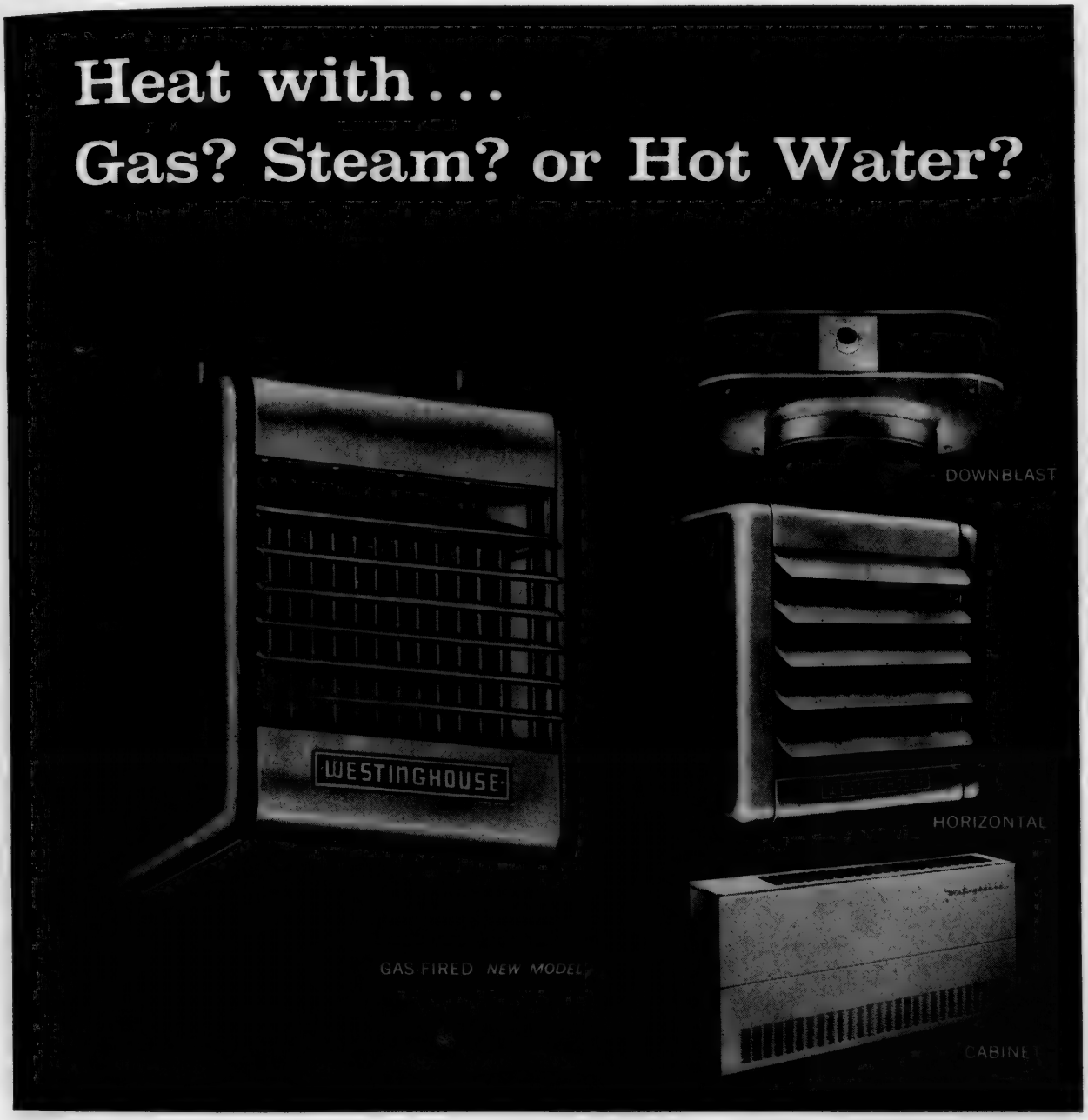


JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE

Typical of more than 4,000 Jenkins Valves of bronze, iron and cast steel serving this building owned by the 55 Public Square Corp., Cleveland.

Sold Through Leading Distributors Everywhere

Heat with...
Gas? Steam? or Hot Water?



the right Btuh...the right mounting...the right distribution pattern

IDEAL FOR HEATING:

- **Garages**
- **Department Stores**
- **Bowling Alleys**
- **Gymnasiums**
- **Entrances & Lobbies**
- **Manufacturing Areas**
- **Cold Spots**
- **Warehouses**
- **Shipping Platforms**
- **Factory Offices**

You'll think Westinghouse custom-made this Unit Heater just to meet *your* space heating requirements : : : and they can be bought right off the shelf.

Gas-Fired Unit Heaters

Sizes from 25,000 to 250,000 Btuh

Steam and Hot Water Applications

Sizes from 265 to 11,500 CFM—15,000 to 684,000 Btuh—65 to 2850 EDR

Attractive Cabinet Models

Sizes from 300 to 2070 CFM—110 to 525 EDR

J-80670

Call your Sturtevant Division Sales Engineer or write:

WESTINGHOUSE ELECTRIC CORPORATION, DEPT. J-6, HYDE PARK, BOSTON 36, MASSACHUSETTS

"WE SECURED EVEN TEMPERATURES THROUGHOUT THIS 14-STORY BUILDING WITH SARCOTHERM HEATING SYSTEM CONTROLS,"

say Slingerland and Booss, architects and engineers

New York's "Avon House," completed in 1957, Architects and Engineers: Slingerland and Booss, 120 Greenwich Street, N. Y. C.

Mechanical Contractors: Fein-Schlosberg, Inc., 1770 Second Avenue, N. Y. C. Owner: The Ten Men Realty Co., Leon Finley, President, N. Y. C.

In the superbly appointed "Avon House" apartments at 340 East 74th Street, New York, the complete automatic heating control job is Sarcotherm. The architects and engineers, Slingerland and Booss, called on Sarco's experienced engineering department to work with them and the mechanical contractor in working out components—controls, vacuum pumps and steam specialties. Besides setting up undivided responsibility of one manufacturer, this policy assured a balanced system with no weak links.

Accurate orifice calculations by Sarcotherm insured proper distribution of subatmospheric steam in the system, even in mild weather. Each of the 2 zones of this building is controlled by a Sarcotherm Continuous Flow Modulating Steam Control Valve. These valves meter the steam to furnish proper heat at any given outside temperature. Control Valves are influenced by outside temperature, wind velocity, and solar radiation, plus differential steam pressure between supply and return mains. A Master Control Panel supplies complete programming operation with automatic control for day, night and morning pickup cycles.

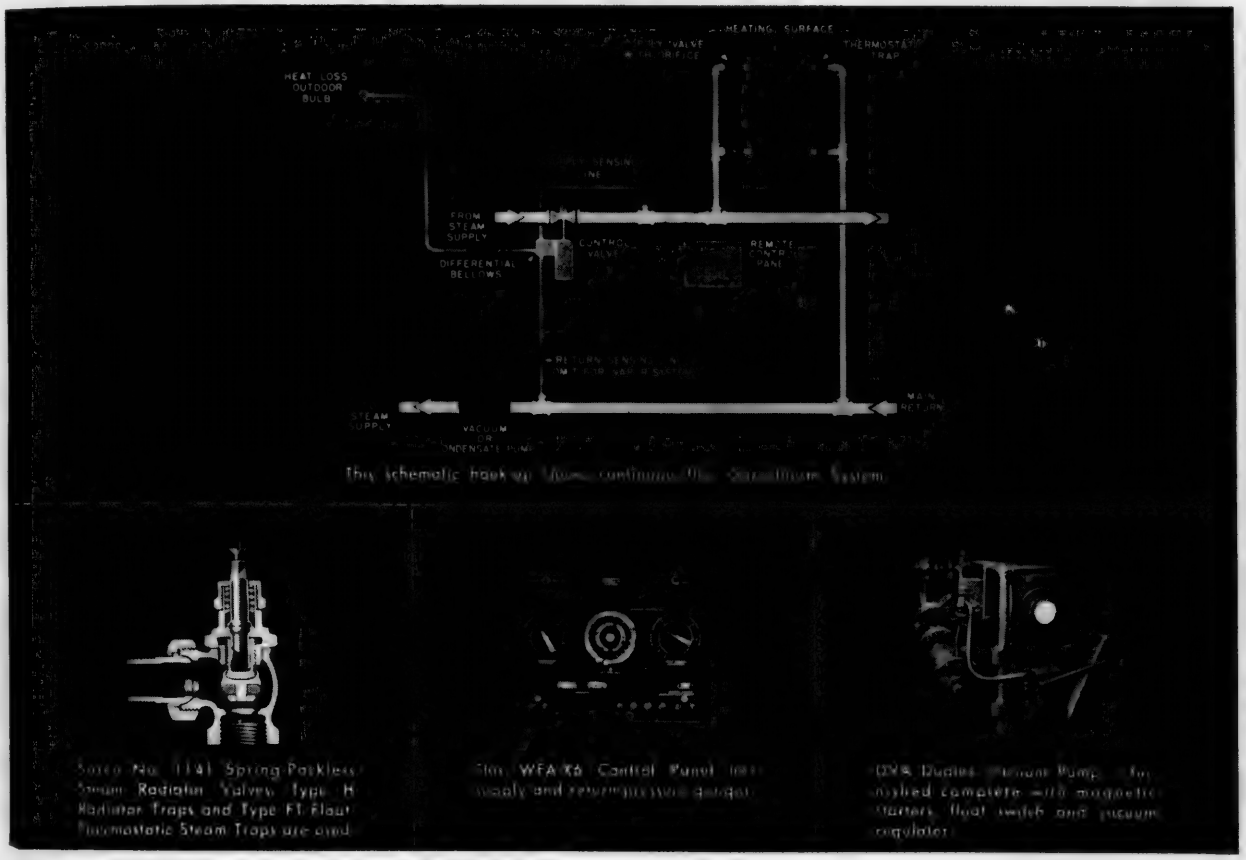
There is ample testimony to the sound judgment of the architects in making this a complete Sarcotherm vacuum heating control system. Since its first day of operation the installation at the new Avon House has been 100% trouble-free.

SARCOTHERM

An Affiliate of SARCO Co., Inc.

635 Madison Avenue, New York 22, N. Y.

"INSTALLATION WAS EASY, THANKS TO SARCOTHERM ENGINEERING SERVICE AND UNDIVIDED RESPONSIBILITY FOR CONTROLS, SPECIALTIES, PUMPS," *say Fein-Schlosberg, Inc., mechanical contractors*



this schematic hook-up [illegible] Sarcotherm System.

Sarco No. 114 Spring Packless Steam Radiator Valves, Type H Radiator Traps and Type FT Float Thermostatic Steam Traps are used.

Sim. WEA-K5 Control Panel [illegible] supply and return pressure gauges.

DVR Duplex Vacuum Pump [illegible] supplied complete with magnetic starters, float switch and vacuum regulator.

Marked advantages were found by the mechanical contractors in the quality of orifice engineering provided by Sarcotherm. Every valve, for example, was calibrated and the orifice plate brazed in at the factory. All units were tagged, unit-packaged, and keyed in with the hook-up drawing. The installation was supervised by Sarcotherm engineers. The installation was rapid and easy. No on-the-job adjustments were necessary.

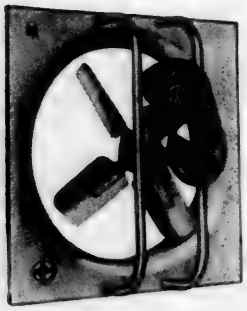
SARCOTHERM

An Affiliate of SARCO Co., Inc.

*

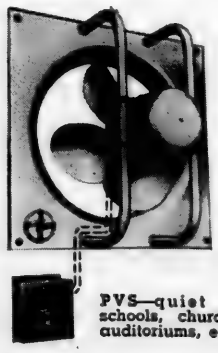
FOR COMPLETE CONTROL SYSTEM CATALOG
write Sarcotherm Controls, Inc.,
635 Madison Ave., New York 22, N. Y.

6176-B

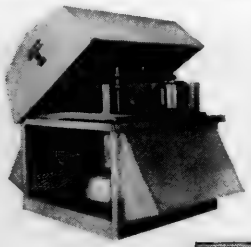


PVB—generally used in factories, warehouses and foundries.

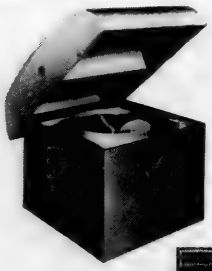
HS—for industrial use, farm buildings, laundries, etc.



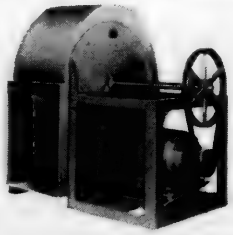
PVS—quiet for schools, churches, auditoriums, etc.



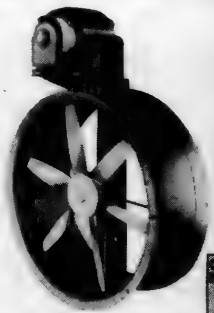
CENTRIFUGAL POWER ROOF VENTILATOR—for auditoriums, schools, churches, public buildings, plants.



PROPELLER-TYPE ROOF VENTILATOR—for apartments, plants, schools, etc.



BACKWARD CURVE BELT DRIVE UTILITY BLOWER—recommended for general ventilation.



DUCT or TUBAXIAL—for paint spray booths, etc. —explosion-proof.

Peerless-Electric®

AIR MOVING EQUIPMENT

is designed for low initial cost and continuous, trouble-free performance.

Peerless Electric air moving equipment offers the user low initial cost and trouble-free, continuous performance. Each unit is completely Peerless built. Motors are designed, engineered and manufactured in the Peerless Electric Motor Division. They are made to N. E. M. A. specifications and performance-matched to the fans or blowers they must power.

Each Peerless Electric unit indicated with the AMCA seal is rated by the new Air Moving and Conditioning Association. Installation data, performance tables, dimensions, ratings, general construction data, recommended specifications, and guarantee information are all available in the new Peerless Electric catalogs. Write for a complete set today.

A COMPLETE LINE OF AIR MOVING EQUIPMENT

Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)

Peerless-Electric

FAN AND BLOWER DIVISION

THE *Peerless-Electric*® COMPANY

1400 W. MARKET ST. • WARREN, OHIO

FANS • BLOWERS • ELECTRICAL MOTORS

Locate Your Nearest Representative in the "Yellow Pages"

SEE OUR CATALOG IN SWEET'S

Centralized Control of Air Conditioning Saves Manpower, Assures Ideal Working Environment

North American Aviation, Inc., Los Angeles, California. Austin, Field & Fry, AIA, architects and engineers; Wm. Simpson Construction Co., general contractor; Western Air & Refrigeration Co., air conditioning contractor; all of Los Angeles.

Manpower savings of at least three men per day, reduced fuel and power consumption, longer equipment life and 24-hour-a-day comfort are made possible by this Johnson Control Center at North American Aviation's busy new headquarters!

From the Center, *one man* operates all the basic heating, cooling and air handling components of a modern high pressure, double duct air conditioning system.

To aid him, all vital operating data needed to keep the system functioning at peak efficiency are transmitted to the panel from remote locations throughout the windowless, three-story building. Simply by scanning the panel or pushing a button, the engineer can check fan operations, temperatures, pressures and related data from well over 100 key control points!

Johnson Control Centers are applied to buildings of all types and sizes. They assure your clients of the very best, most productive working environment that air conditioning can produce. And the owner quickly gets his investment back through major savings in operating costs and manpower. Your local Johnson branch has all the facts. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

TEMPERATURE CONTROL SYSTEMS FOR SCHOOLS, OFFICES, FACTORIES, STORES, HOSPITALS, HOTELS, PUBLIC BUILDINGS

MULTI-VENT®

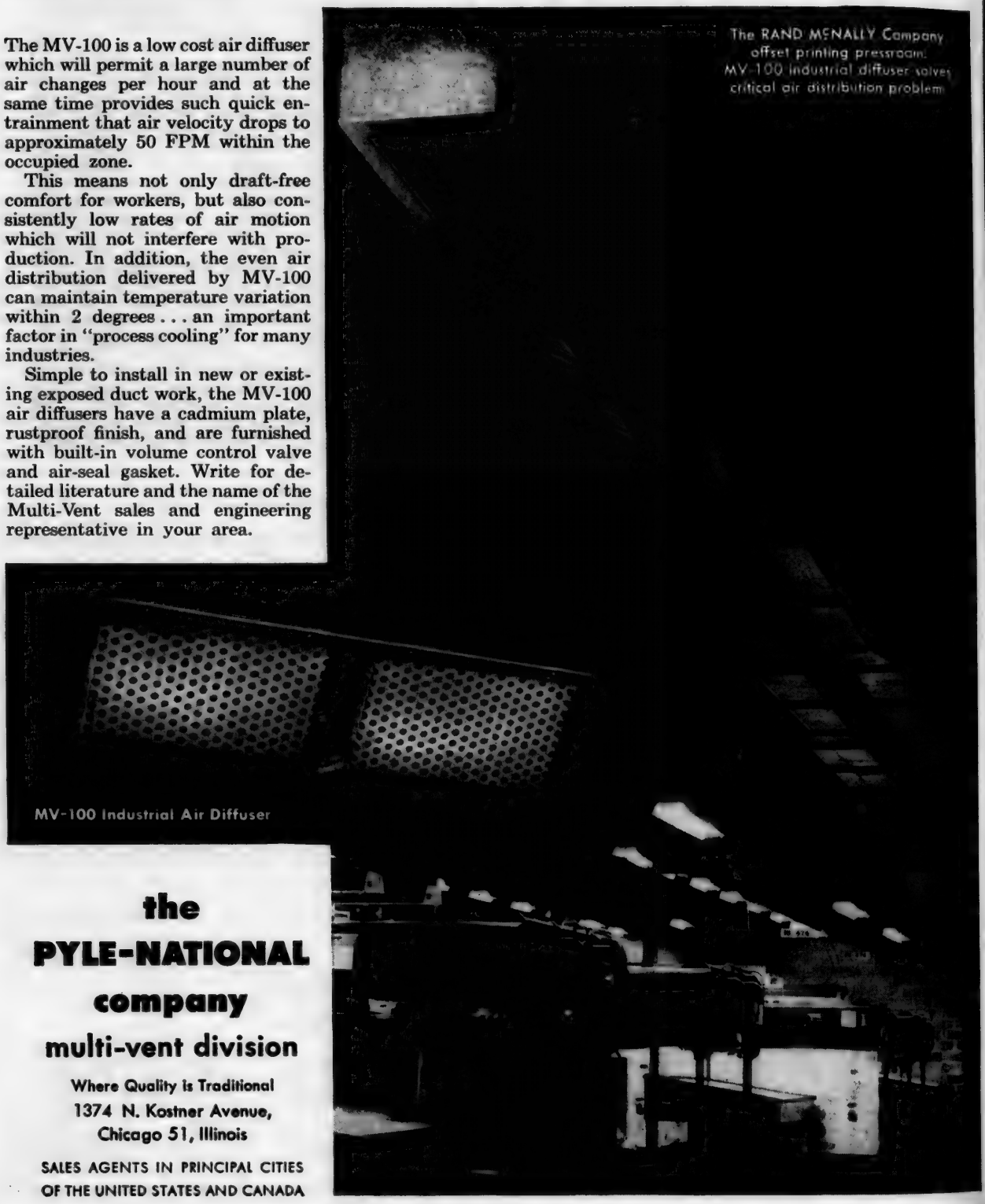
"INDUSTRIAL" AIR DIFFUSER

DELIVERS DRAFT-FREE AIR AT LESS THAN 2½¢ per CFM!

The MV-100 is a low cost air diffuser which will permit a large number of air changes per hour and at the same time provides such quick entrainment that air velocity drops to approximately 50 FPM within the occupied zone.

This means not only draft-free comfort for workers, but also consistently low rates of air motion which will not interfere with production. In addition, the even air distribution delivered by MV-100 can maintain temperature variation within 2 degrees . . . an important factor in "process cooling" for many industries.

Simple to install in new or existing exposed duct work, the MV-100 air diffusers have a cadmium plate, rustproof finish, and are furnished with built-in volume control valve and air-seal gasket. Write for detailed literature and the name of the Multi-Vent sales and engineering representative in your area.



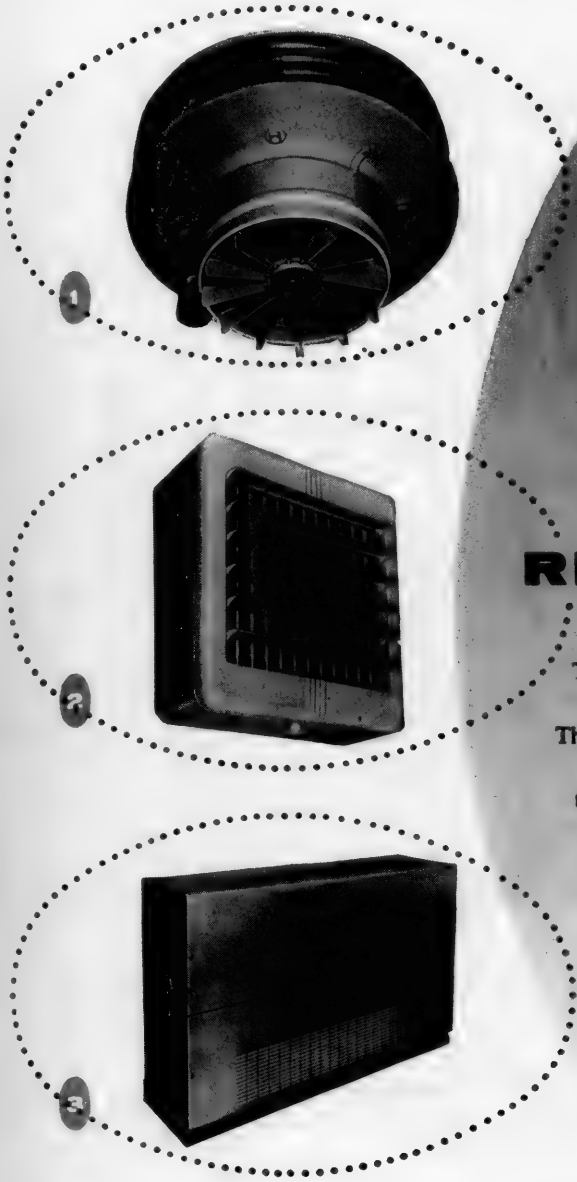
The RAND McNALLY Company offset printing pressroom. MV-100 industrial diffuser solves critical air distribution problem

MV-100 Industrial Air Diffuser

the
PYLE-NATIONAL
company
multi-vent division

Where Quality is Traditional
1374 N. Kostner Avenue,
Chicago 51, Illinois

SALES AGENTS IN PRINCIPAL CITIES
OF THE UNITED STATES AND CANADA



McQuay

UNIT HEATERS

For EVERY Need

AND ALL WITH

RIPPLE FIN COILS

McQuay Unit Heaters have modern styling. The attractive cabinets are finished in neutral hammer enamel and blend in well with all surroundings. They are available in an exceptionally wide range of sizes and capacities for either steam or hot water, to enable you to meet the requirements of every job—old or new, large or small. McQuay Unit Heaters will solve any low cost heating problem anywhere, with uniform and quiet delivery of heat and with that extra efficiency afforded by Ripple Fin Coils. Years of experience, years of research provide the know-how for which McQuay is famous.

McQuay Means Quality

1 DOWN FLOW UNIT HEATERS

Capacities from 38,500 to 500,000 BTU/hr. For steam or hot water. Adjustable radial diffusers furnished with each unit. Four types are available.

2 HORIZONTAL UNIT HEATERS

Capacities from 17,700 to 400,000 BTU/hr. For steam or hot water. Adjustable louvers standard equipment. Double deflection grilles available on special order.

3 CABINET UNIT HEATERS

Capacities from 19,700 to 108,000 BTU/hr. For steam or hot water. Designed for fully exposed, semi-recessed or fully recessed mounting on either floor, wall or ceiling.

McQuay INC.

REFRIGERATION
HEATING
AIR CONDITIONING

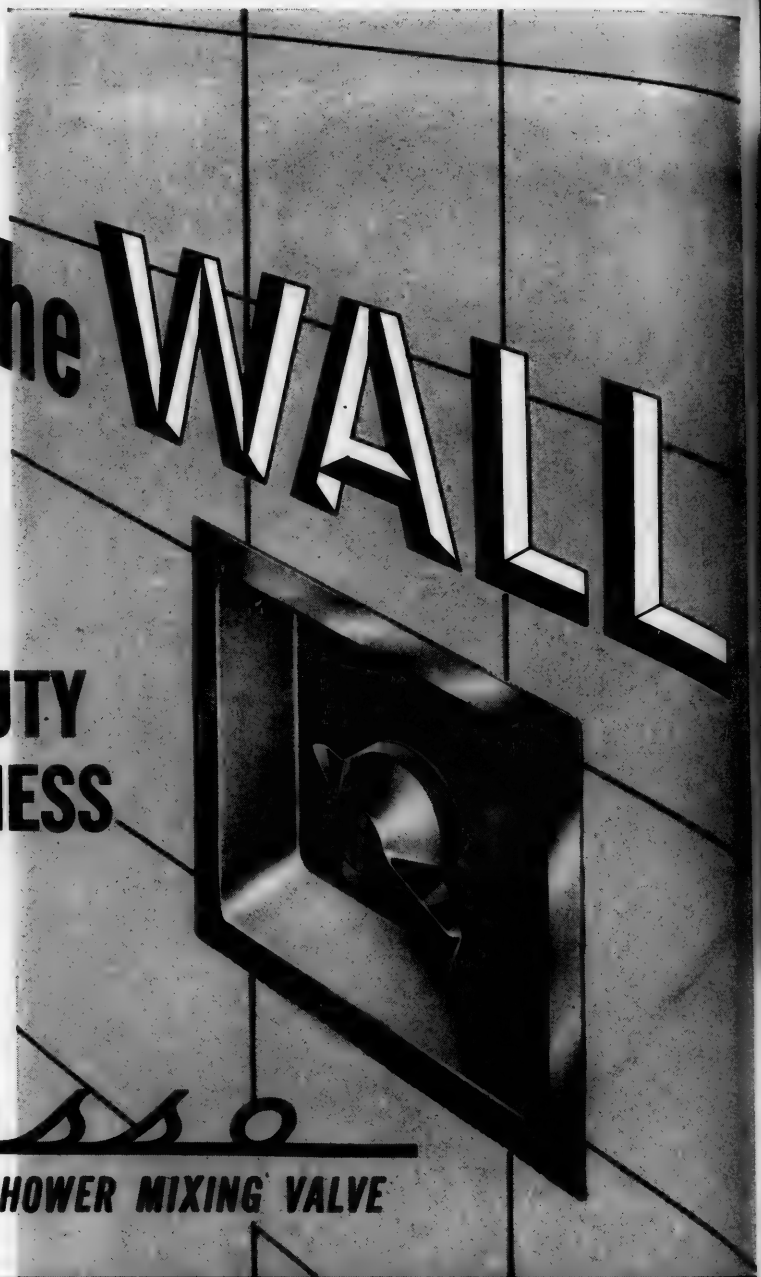
McQuay, Inc., 1619 Broadway St. N.E., Minneapolis, Minnesota.

Representatives in all principal cities.

RECESSED into the WALL

for . . .

EXTRA SAFETY
LUXURIOUS BEAUTY
ADDED CLEANLINESS



THE *Recesso*

THERMOSTATIC SHOWER MIXING VALVE

Another Quality Product of

THE *Lawler Line*

OF THERMOSTATIC CONTROL VALVES

L[illegible] an exclusive advantage [illegible] an altogether new dimension in modern shower control. It's the RECESSO the only shower valve that's built into the wall for complete safety. NO PROTRUDING EDGES to cause bodily harm. DE LUXE DESIGN that's crisp and clean-cut . . . EASY CLEANING because there's nothing to collect soap scum, dirt or grime.

COMPLETE SAFETY FROM SCALDING

New advanced valve design makes scalding actually impossible. [illegible] RECESSO gives

Got a Real Tough Starting Problem ?

Single-phase Type RA ½ to 15 hp.

Wagner Repulsion-Start Induction Motors start heavy loads with low current

The Wagner Type RA is the work-horse of the single-phase motor field. It combines high starting torque for quick, easy starts with low starting current and minimum light flicker. It has a constant high operating speed, even under overload, and a flat efficiency curve over a wide operating range.

You practically eliminate service problems when you power tough single-phase applications with Wagner RA Motors. They have unmatched ability to start high inertia or heavy friction loads repeatedly and they give many years of unfailing service.

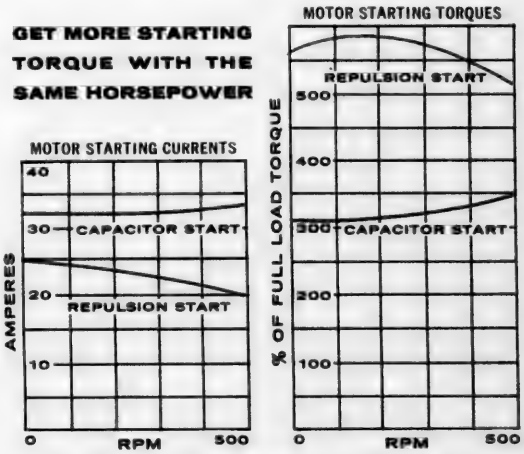
Let a Wagner Sales Engineer show you how these motors can be applied to your needs. Call the nearest branch office or write for Bulletin MU-220.

Wagner Electric Corporation

6400 Plymouth Ave., St. Louis 14, Mo.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

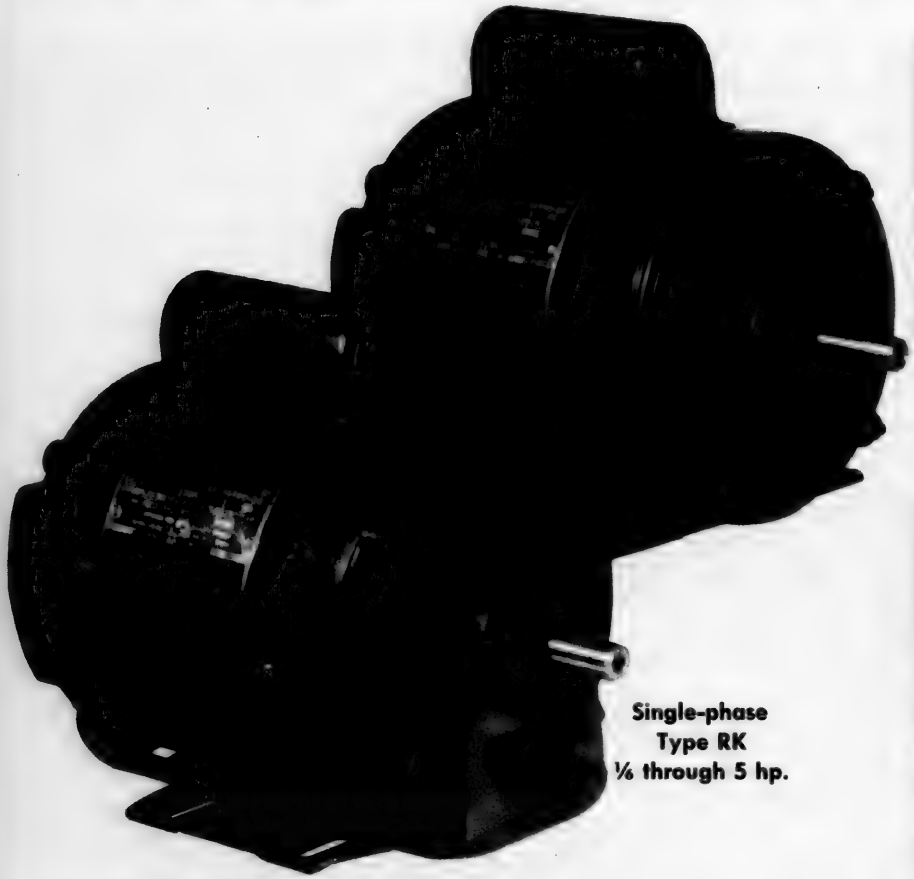
GET MORE STARTING TORQUE WITH THE SAME HORSEPOWER



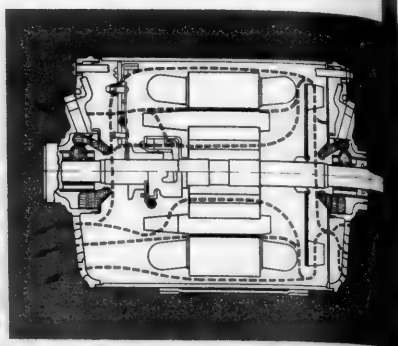
ONE HP, 1750 RPM, 60 CYCLES, 230 VOLTS

Integral Ratings, 1-5 hp are available in the latest NEMA Frame Sizes

Got a Normal Starting Application?



Single-phase
Type RK
⅙ through 5 hp.



EFFICIENT COOLING SYSTEM—The improved ventilating system used in these motors directs a large volume of air through the motor to effectively reduce temperatures and add to motor life. Cross section above indicates direction of air flow.

QUICK BREAK SWITCH—The starting winding and capacitor are disconnected from the line by the Wagner Switch—test-proved to make more than a million makes and breaks . . . the equivalent of two starts per hour for 50 years.

WAGNER CAPACITOR-START MOTORS provide dependable starts... long troublefree life

Here's the single-phase general purpose motor that gives more horsepower with less bulk—is rugged enough to permit direct mounting, compact enough to fit in tight spots. Available with sleeve or ball bearings — with rigid bases or with resilient mountings for exceptionally quiet operation.

ALL-ANGLE OPERATION

The sleeve bearing design in fractional hp ratings, has a positive lubrication system that permits operation in any position. All angle mounting can mean important savings in initial costs to manufacturers—can help the design engineer in a tight spot.

You can get these motors from leading motor distributors in your community and from Wagner Sales Offices in 32 principal cities. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details.

MYLAR* INSULATION — Mylar-paper laminated slot insulation gives top protection against moisture, adds thermal stability, to give more application versatility and longer life when unexpected overloads occur.

*DuPont Trademark

Wagner Electric Corporation
6400 Plymouth Ave., St. Louis 14, Mo.
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

WAGNER "48" SPLIT PHASE MOTORS . . . 1/6, 1/4, 1/3 hp.

for low starting torque requirements

If you need a small fractional horsepower motor for use on fans and blowers or on a wide variety of easy-to-start machines and appliances, you can't beat the Wagner "48" Type RB Motor. It offers all the advantages of the Type RK described above, with the exception of high torque capacitor starting. This smaller, lighter, limited use motor can solve many application problems economically.

RELIABLE VENTILATION IN A PACKAGE

"Buffalo" Belted Vent Sets

Quiet, ruggedly constructed and compact, "Buffalo" Belted Vent Sets are equally adaptable to indoor or outdoor installations. Double-curved blades prevent overloading. Inlet vane design reduces turbulence and air noise. Insures quiet, stable fan operation, even under unfavorable inlet conditions. Available with all-weather drive cover for roof or other outdoor installations. Capacities range from 500 to 20,000 cfm. Adjustable pitch motor sheaves permit variable capacity.

For full information, write for Bulletin 3720-A.

SPECIAL FEATURES AVAILABLE

All-Weather Cover and Rain Shield. Drain Connection in bottom fan housing. Access Door in scroll. Inlet and Outlet Screens. Non-sparking Aluminum Wheels. Enclosed or Explosion-Proof Motors. Ball Bearing Motors. Anti-Vibration Pads. Stainless Steel or Aluminum Construction for Units having all parts in contact with gas or fumes. Belt Guard. Gravity Type, Hand-Operated or Motor-Operated Outlet Shutters. Special Protective Coatings on Inside Housing and Wheel.

All "Buffalo" products feature the famous "Q" Factor—the built-in Quality that assures trouble-free satisfaction and long life.

VENTILATING
AIR CLEANING
AIR TEMPERING
INDUCED DRAFT

BUFFALO FORGE COMPANY

EXHAUSTING
FORCED DRAFT
COOLING
HEATING
PRESSURE
BLOWING

BUFFALO, N.Y.

Buffalo Pumps Division, Buffalo, N. Y.

Canadian Blower & Forge Company, Ltd., Kitchener, Ont.

Now PRE-ENGINEERED to save you

NEW Carrier HEAT PUMP

are factory-tailored to meet

No longer is it necessary for the architect and engineer to spend tedious hours selecting and matching heat pump components in an effort to obtain the proper balance for a given commercial or industrial installation!

Now he need only refer to the Carrier Heat Pump Weathermaker* Systems Chart shown below to determine the pre-selected components that provide exactly the proper range of heating and cooling capacity. It's another first from the company that offered the first commercial heat pump more than a quarter of a century ago.

These Heat Pump Weathermaker Systems offer a maximum latitude of design. There is a choice of individual room units, central station or multi-zone units with duct work to distribute conditioned air. You may also select air-cooled condensers or water-chilling machines to match the heat source and capacity desired. And because all Carrier components come in a wide range of basic capacities, there is a system that is tailored to meet the requirements of any climate.

The new pre-engineered Heat Pump Weathermaker Systems are available in factory-rated capacities from 5 to 100 tons and in four basic types: air to air, air to water, water to air and water to water. In larger sizes, too. Call the Carrier dealer listed in the Yellow Pages of your telephone book for details now, or write Carrier Corporation, Syracuse, New York.

*Reg. U.S. Pat. Off.

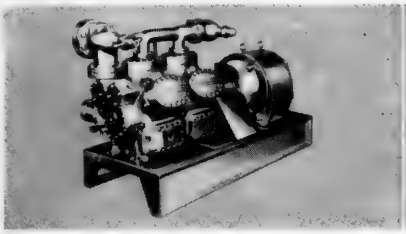
Selecting components is simple as ABC with

AIR TO WATER COOLING CAPACITY†			HEATING OUTPUT, BTU/HR			EQUIPMENT					
TONS	CONDENSING TEMPERATURE °F	COMPRESSOR BHP	OUTDOOR AIR DESIGN TEMP. 0° F	+10° F	+20° F	COMPRESSOR UNIT REFRIGERANT R-12	C-500	COMP. MOTOR HP	OUTDOOR AIR UNIT	CONDENSER-CHILLER MODEL No.	GPM
6.7	115	9.2	34,200	43,500	54,300	5F30		10	9A8	DXH807K	16.1
10.7	114	13.9	52,000	65,600	82,100		5F40	15	9A14	DXH1007K	25.7
13.1	118	18.4	63,200	81,000	100,800	5F60		20	9A14	DXH1008K	31.4
15.5	118	21.4	73,500	94,300	117,900		5F60	25	9A16	DXH1009K	37.2
21.1	116	28.0	95,500	122,700	154,000	5H40		30	9A25	DXH1209K	50.6
30.9	118	42.3	149,000	190,000	238,000	5H60		40	9A33	DXH1411L	74.2

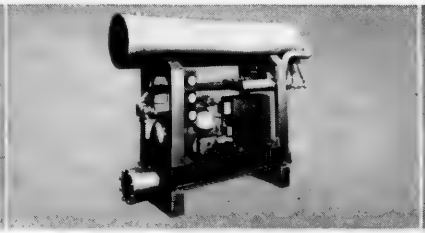
hours of selection time!

WEATHERMAKER SYSTEMS

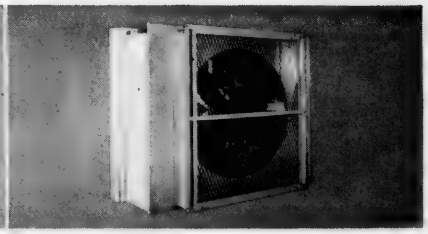
commercial and industrial requirements



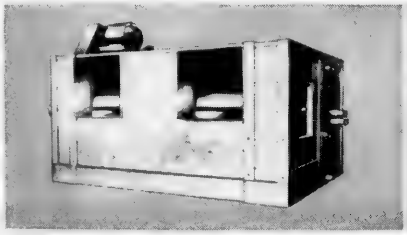
Heart of Heat Pump Weathermaker Systems: Dependable Carrier Compressors are the product of more than 50 years of refrigeration experience.



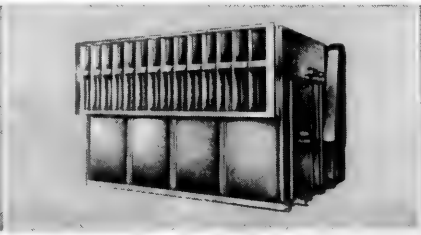
For water source or distribution: Carrier Water-Cooling Machines match coolers, condensers and hermetic compressors for maximum efficiency.



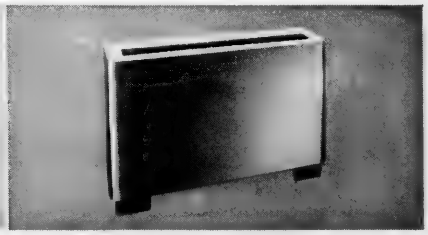
For air source application: New Carrier Air-Cooled Condensers are installed singly or in multiples to perfectly match required capacity.



To heat and cool through ducts: Carrier Central Station Weathermakers feature building block design with system mated fans and coils.



For zone control: Carrier Zoning Weathermakers permit heating or cooling of up to 14 zones or rooms. Heats and cools different zones simultaneously.



For room-by-room conditioning: Carrier Room Weathermakers give individual control for direct expansion or chilled and hot water air conditioning.

this new Carrier Heat Pump Weathermaker Systems Chart

AIR TO WATER COOLING CAPACITY†			HEATING OUTPUT, BTU/HR			EQUIPMENT					
TONS	CONDENSING TEMPERATURE °F	COMPRESSOR BHP	OUTDOOR AIR DESIGN TEMP. 0° F	+10° F	+20° F	COMPRESSOR UNIT REFRIGERANT R-12	C-500	COMP. MOTOR HP	OUTDOOR AIR UNIT	CONDENSER-CHILLER MODEL No.	GPM
36.2	119	49.0	166,000	215,000	271,000		5H60	50	9A37	DXH1412L	86.9
42.0	116	55.0	193,000	246,000	308,000	5H80		60	9A50	DXH1611L	101.0
52.8	116	69.5	244,000	314,000	393,000	5H40-60		75	9A63	DXH1613L	126.7
71.8	119	96.7	332,000	428,000	538,000		5H120	100	9A75	DXH2012L	172.0
98.1	117	127.0	461,000	590,000	744,000		5H80-80	125	9A112	DXH2411L	235.0

†*Comparable charts for other types of systems available from your Carrier Dealer*

ANEMOSTAT reports on All-Air High Velocity Systems

Selection Manual No. 60 will be sent to you promptly on request.

Anemostat Corporation of America pioneered the development of All-Air High Velocity Systems. Anemostat leadership in high velocity systems has resulted in more than 500 fine installations using more than 60,000 units in office buildings, schools, hospitals, auditoriums, etc. throughout the United States, Canada and Mexico.

Anemostat Selection Manual No. 60 contains complete information on the many architectural and engineering advantages of the Anemostat All-Air High Velocity System.

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

ANOTHER NEW DEVELOPMENT BY IRON FIREMAN

Fires heavy oil with light oil dependability

Burns any fuel oil through heaviest No. 5. The ability to fire either heavy or light oils and to modulate over a wide range are the two outstanding features that make the Micro-Mist burner unique in its field. An entirely new principle is employed in the two-stage atomizer that converts fuel oils, including heavy No. 5, to an air-oil fog that is readily ignited by an electric spark. No gas pilot required.

Look at these features. Models of Iron Fireman MicroMist burners are available for two important uses: as a component part of a boiler-burner unit (shown above) or as a conversion burner. They are as easily installed as a conventional gun type burner. No special boiler front or boiler pitting is required. Various grades of oil can be fired without burner readjustment, and with little more attention than a domestic oil burner. Heating of oil is required only in those cases where it is not sufficiently fluid for pumping.

Forced draft models available. Illustration above shows the compact, integral forced draft system for pressure sealed boilers. No high stack required.

Write for catalog and specifications

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT

FOR HEATING, POWER, PROCESSING

IRON FIREMAN MANUFACTURING CO.
3073 W. 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send me more information and specifications on the Iron Fireman MicroMist burner.

Name_____

Firm_____

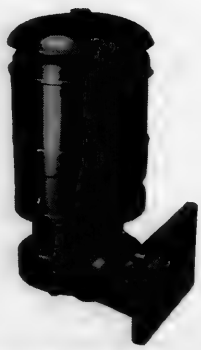
Address_____

City_____ Zone____ State_____

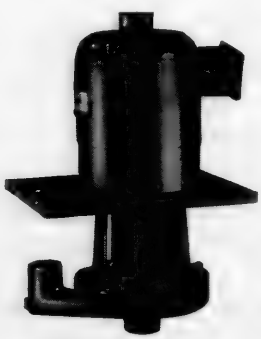
Vertical air washer
uses A-C flange-mounted pump directly mounted on washer reservoir.

A choice of pumps

for air-conditioning equipment—sealless or with mechanical seal...



Only 5-inch submergence
is needed by submerged-mounted models. They are sealless for season-after-season reliability.



Four optional positions
for the motor are possible with this sidewall-mounted model. It is also sealless to minimize maintenance.

HERE'S a line of air-conditioning pumps from Allis-Chalmers engineered with one idea: *to make equipment designers' jobs easier*. Here's how A-C did just that:

- **Choice of mounting** — Complete line permits *six* different mounting methods . . . for design flexibility of all types of systems.
- **Less tank room required** — Submerged models need only *5-inch* submergence. You save on tank size.
- **Choice of impeller** — Single-suction impellers are available in either enclosed or open design.

IN ADDITION to submerged and sidewall-mounted units, Allis-Chalmers also offers close-coupled and horizontal pumps to meet 99% of all air-conditioning applications.

A-C PUMP EXPERTS can help with your application. Contact your Allis-Chalmers representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5700

FRICK TRADE MARK

AT THE

"CROSSROADS OF THE SOUTH"

New Fulton Federal Building in Atlanta uses Frick Air Conditioning throughout.

Half a block from the famous intersection of Peachtree St. at Five Points, in historic Atlanta, is the new home of the Fulton County Federal Savings & Loan Association.

All planning was directed toward achieving the most modern and distinctive bank-office building in the South. Eight different types of domestic and foreign marble were used in the construction. The entire building is equipped with zoned year-around air conditioning.

Five Frick "ECLIPSE" compressors supply the refrigeration for chilling the water for air conditioning. Four of the compressors in a penthouse handle the cooling of the eight top floors, while the other machine, located in the basement, serves the remaining floors. The entire system is fully automatic. Mr. William M. Scurry, President, states, "Since this Frick system has been installed, it has proved highly satisfactory in every respect."

Architects: Abreau and Robeson, Inc., Atlanta, Georgia.

For that all-important air conditioning, ice making, quick freezing or any other refrigeration work of yours, call the nearest Frick representative. Branch Offices and Distributors are located in principal cities the world over. They have the knowledge and equipment to solve all of your cooling problems.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

Four Compressors Located in Penthouse

Air Conditioned Banking Room in Fulton Federal Savings

"Off-the-shelf" delivery

— another example of how you benefit when you select American Blower heating equipment

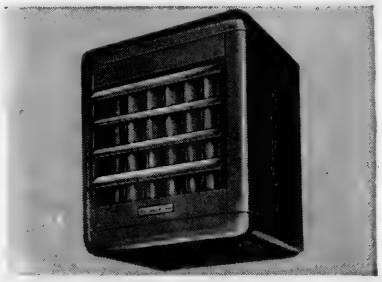
It's a *wide-open* market. Unit heaters are going into most new commercial and industrial buildings . . . and they're used extensively for modernization. Pick up your full share of the profits! Sell competitively priced American Blower Venturafin® Unit Heaters. Both vertical and horizontal designs are available for "off-the-shelf" delivery from *local* stocks.

Sales points: Venturafin Unit Heaters waste no floor or wall space, warm without time lag to ideal comfort conditions, can fit into steam or hot-water systems. And they offer your customers these other important benefits:

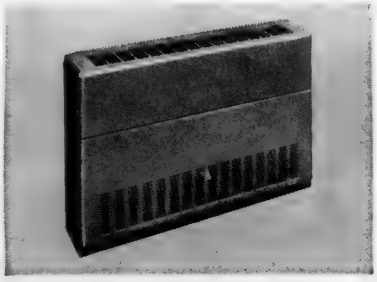
- **Packaged heating** — fast installation. Complete, ready to use with simple connections to steam or hot water.
- **Pre-engineering** — sizes to handle all requirements. Just pick the right unit from the catalog. No on-the-job engineering required.
- **Certified ratings** — meet rigid unit-heater test codes.

Add to your profits. Sell the complete line of American Blower Heaters. Get details from your distributor, or write us direct: American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

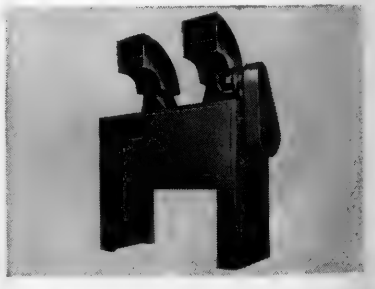
It pays to standardize on American Blower!



Gas-fired unit heaters — rugged; 50,000 to 230,000 Btu/hr. input.



Cabinet heaters — attractive, quiet. Models for steam or hot water.



Industrial heaters—available through American Blower branch offices.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

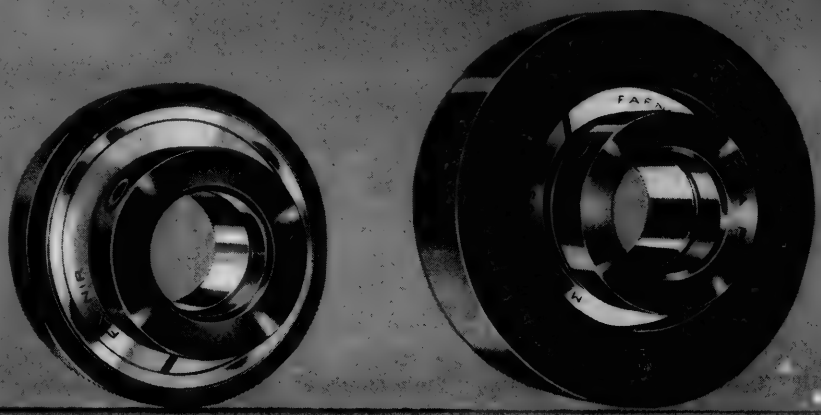
AMERICAN-Standard
AMERICAN BLOWER DIVISION

For simpler design and construction
of air conditioning systems . . .

Fafnir

rubber-cushioned

Ball Bearings



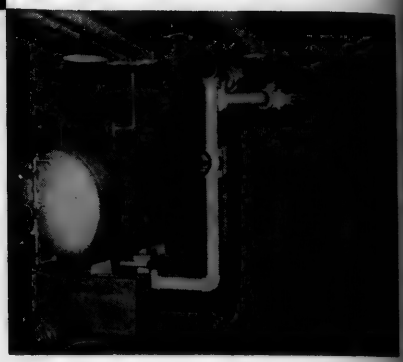
NO METALLIC GROUNDING SPRINGS OR CLIPS NEEDED

For complete data including dimensions and load ratings, write for the new Fafnir bulletin on air conditioning system ball bearings. The Fafnir Bearing Company, New Britain, Connecticut.

Super-quiet operation isn't the only advantage of the Fafnir Ball Bearing Units designed expressly for air conditioning systems. The grommet that encases each bearing is made of electric current conducting rubber which means: (1) No metallic grounding springs or clips are needed to run off static electricity; (2) A possible source of noise is eliminated.

Here is a typical example of the Fafnir "attitude and aptitude"—a way of looking at bearing problems from the *designer's viewpoint* and the ability to supply the right bearing for the need. It represents one of many FAFNIR FIRSTS in the development of ball bearings and ball bearing units for industry.

FAFNIR
BALL BEARINGS



Plumbing and fire protection with

USS National Pipe—

St. Louis Federal Housing Project

USS NATIONAL Steel Pipe was used in the plumbing and fire-protection systems of the George L. Vaughn apartments —federal housing project in St. Louis, Missouri. Approximately 11,304 feet of pipe, ranging in size from ¾" to 8", comprises the systems in the four buildings.

In the plumbing systems, the pipe is used for hot and cold water supply mains and hot water return mains. In the fire-protection systems, an 8" main supplies water to each building, where there is a fire hose cabinet on each landing supplied by a 6" riser. A constant pressure of 100 psi is maintained throughout each fire-protection system.

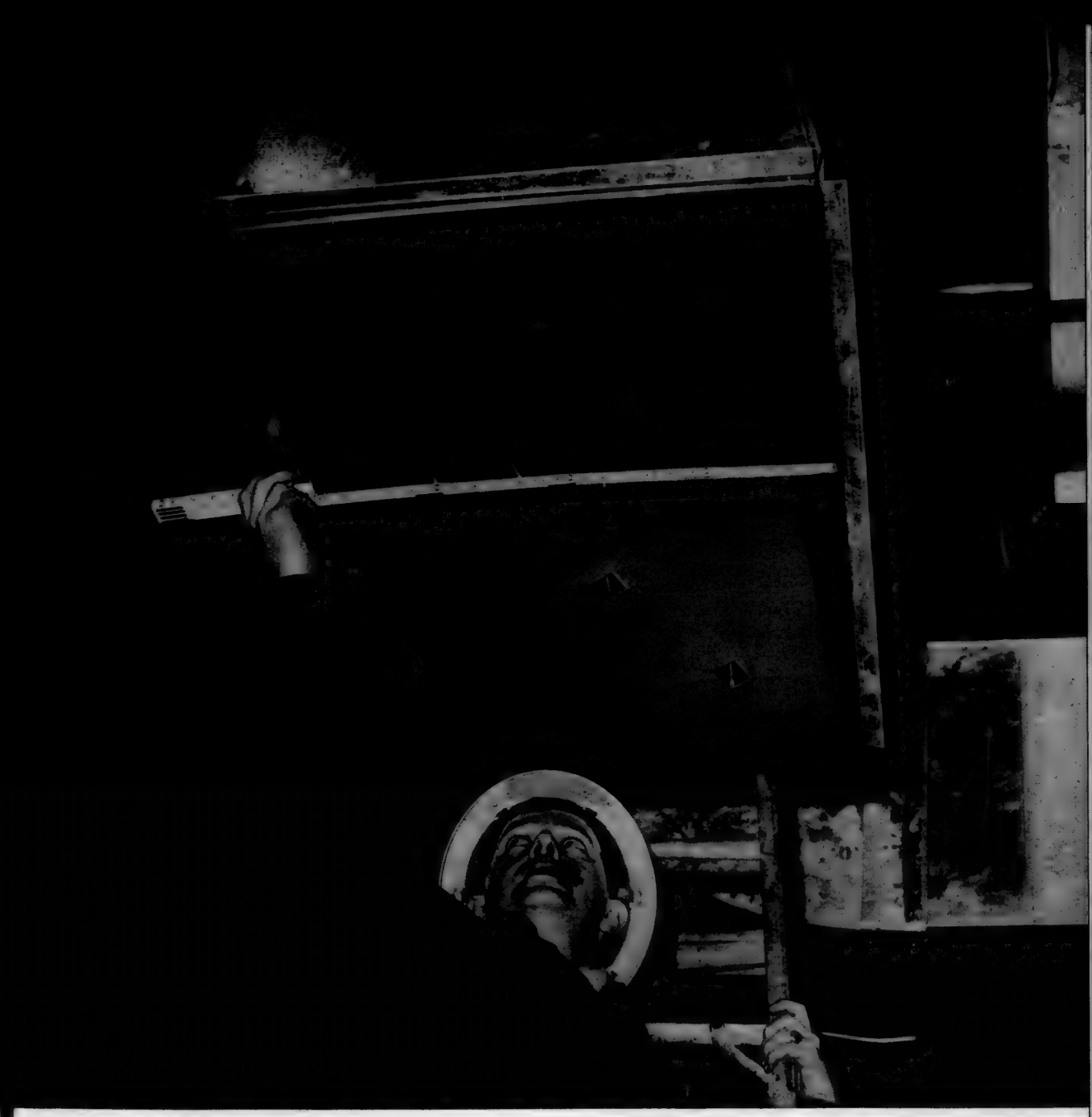
Need first-quality pipe for air-conditioning, heating and power installations? Need seamless and standard pipe that will pay you back in outstanding service many times over for every dollar you spend for it? Then say "NATIONAL PIPE" every time. And, for further information or immediate assistance with your pipe problems, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

USS and National are registered trademarks

"The world's largest and most experienced manufacturer of tubular products—NATIONAL TUBE"

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York



ULTRALITE®
.the only duct liner made exclusively of strong textile-type glass fibers...

"It will not pull apart under high vibration and high wind velocit conditions," says the Consulting Engineer who recently specified 15,000 f of Ultralite Duct Liner for one of America's outstanding new office build ings. "One of the major advantages of Ultralite liner over other forms the long, fibrous structure which gives the material greater strength fo retaining its structural shape."

Ultralite is the *only* glass fiber insulation made exclusively of lon strong, textile-type fibers. It's more rugged, more resilient—importa advantages in duct systems continually subject to vibration and velocit And easy-handling Ultralite offers exceptional acoustical and thermal eff ciency, plus lower friction loss.

With all its advantages, Ultralite costs not a penny more. Specif Ultralite—and you get the ultimate in modern-day duct insulation an duct liner!

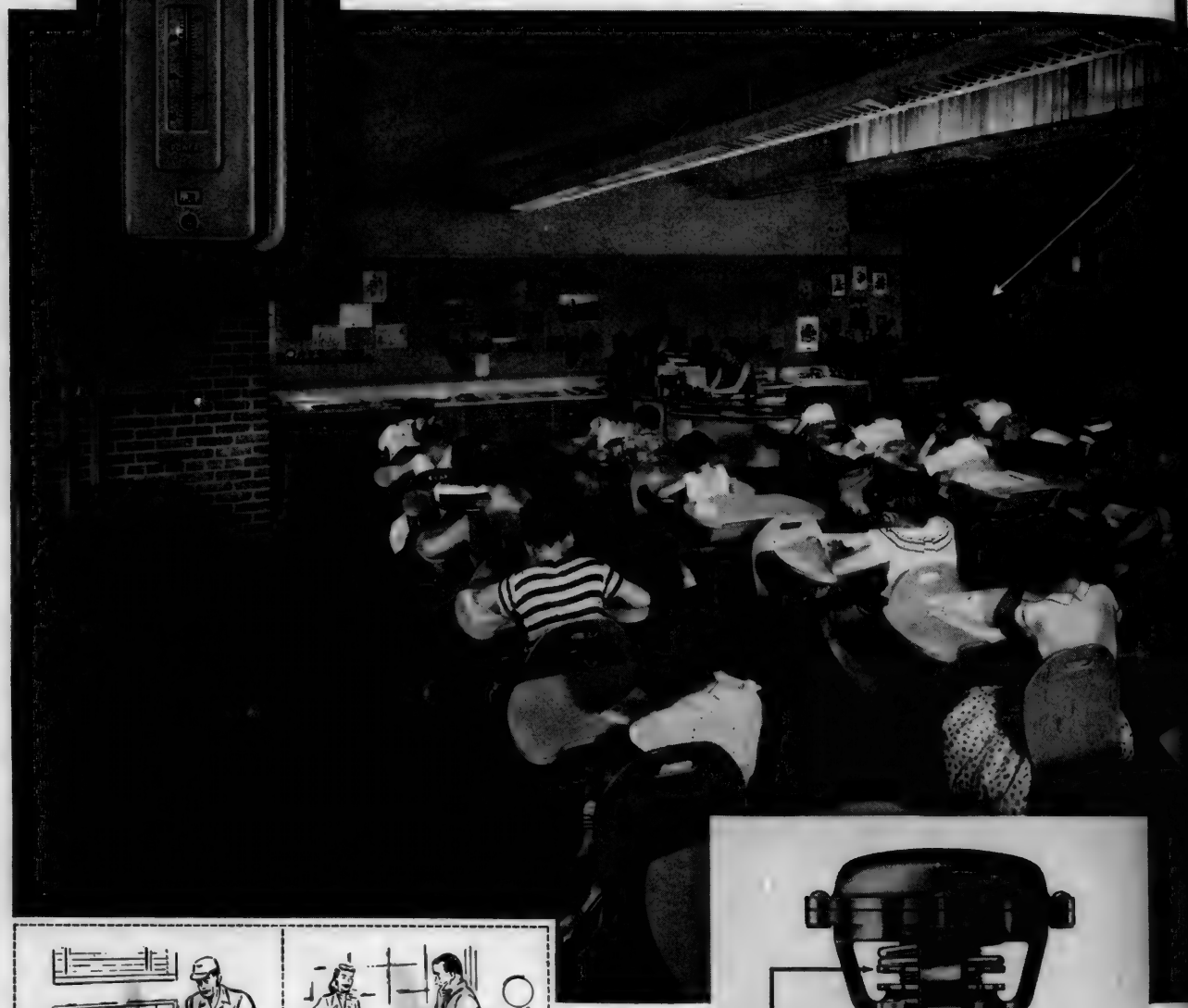
FOR INFORMATION AND PROMPT DELIVERY
SEE YOUR ULTRALITE DISTRIBUTOR
(LISTED IN THE YELLOW PAGES IN 72 CITIES)

GUSTIN-BACON *Mfg Co.* GUSTIN gb BACON

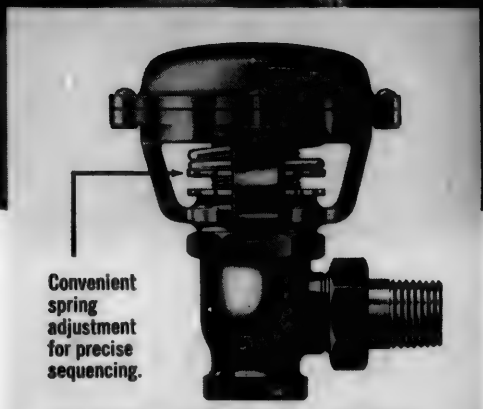
222 W. 10th St., Kansas City, Mo.

How schools benefit from

A truly gradual acting thermostat—controls unit ventilators and convectors. Day-Night type thermostat available with automatic changeover.



Banish packing Maintenance and Leakage with—



Powers PACKLESS Control Valve

Powers PACKLESS Control Valves are standard for unit ventilators, convectors and unit air conditioners

They give more ACCURATE control—due to less valve stem friction. SIMPLE, few moving parts with minimum vulnerability to environmental hazards such as dirt, moisture, etc.

Barth Controls are specifically designed for Unit Ventilators.

POWERSTROKE Damper Operator

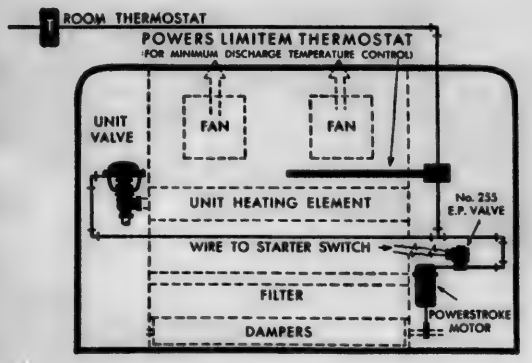
POWERSTROKE Damper Operator gives smooth gradual action of unit ventilator dampers. Accessible adjustment allows sequencing of dampers in accordance with A.S.H.A.E. unit ventilator control cycles.

QUALITY FEATURES provided by

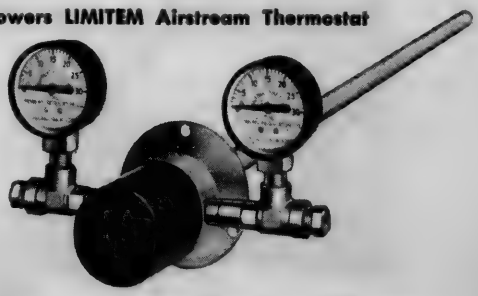
POWERS

MODERN pneumatic system of UNIT VENTILATOR CONTROL

Teachers, Pupils and Taxpayers all benefit when you specify POWERS *temperature control*



Powers LIMITEM Airstream Thermostat



A precision instrument with calibrated dial and adjustable sensitivity to give precise throttling range.

Greater **SIMPLICITY** of Powers **Direct Control** Prevents OVER-heated classrooms and cold drafts and insures Lowest Cost Maintenance

Powers LIMITEM Airstream Thermostat with its efficient direct control gives precise regulation of unit ventilator discharge temperature without using complicated auxiliary devices.

LIMITEM performance and reliability have been time tested and proven in thousands of schools. Valve and damper operator which it controls are shown on opposite page.

Powers Responsibility for correct installation and dependable operation is accomplished by directly employed Powers mechanics with years of unit ventilator control experience.

There is no extra charge for Powers Quality and year after year dependability. When you specify a Powers modern pneumatic control system for unit ventilators your client gets the best. There is no better.

Use Powers 65 years of Experience and engineering know-how to help you select the most efficient type of control for schools or other buildings.

A nearby Powers factory and field trained engineer will gladly assist you. There's no obligation. Call our nearest office.

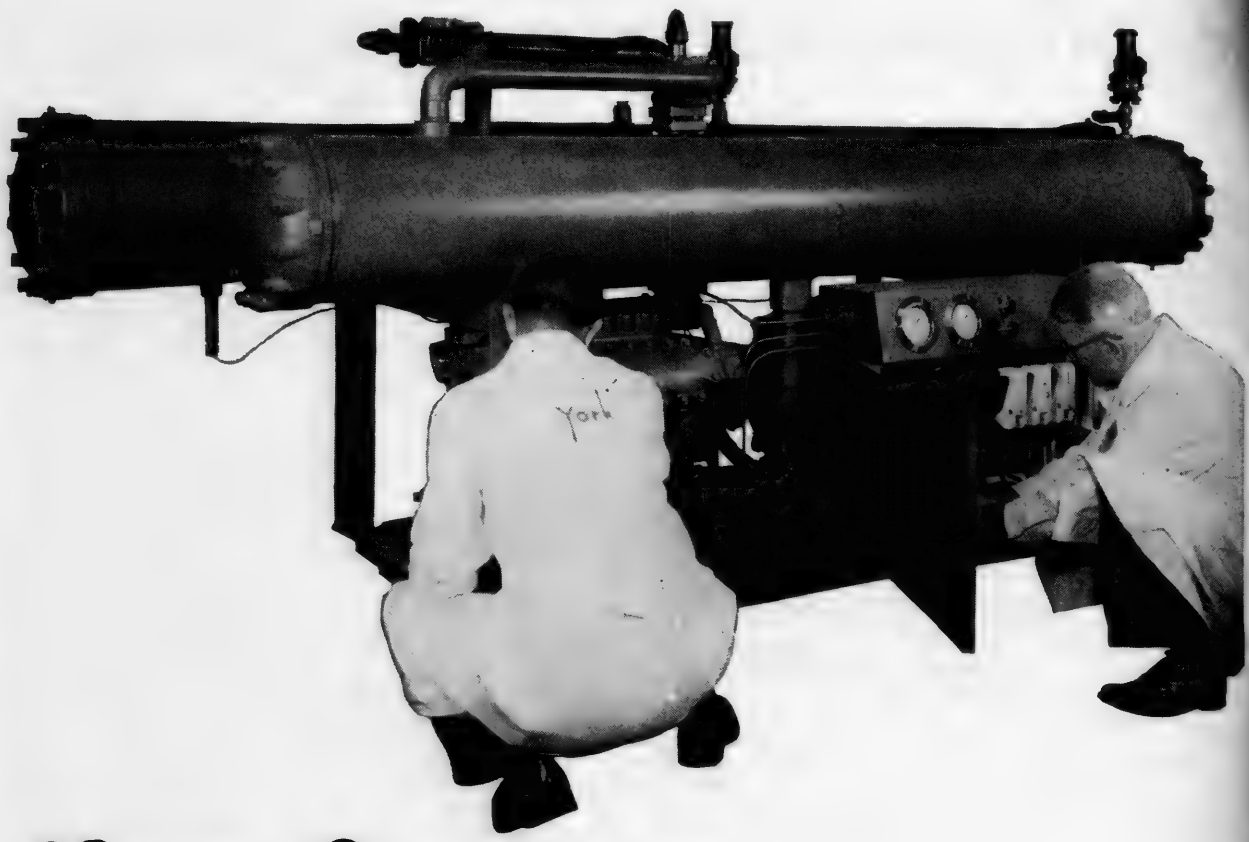
POWERS CONTROL

(c95)

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A. and Canada*

65 Years of Automatic Temperature and Humidity Control



More Cooling

IN 20% LESS FLOOR SPACE WITH YORK PACKAGED WATER CHILLER!

Compact, Factory-Assembled Unit Installs Anywhere In The Building—Without Costly Installation!

York Packaged Water Chillers offer consultants, architects and building managements the first practical answer to the critical space/cost problems in air conditioning new buildings. Each complete, factory-assembled package features integrated arrangement of all components—with built-in assurances of substantially reduced operating and maintenance costs!

Exclusive Flooded Coolers and positive refrigerant feed control mean top efficiency over the entire range of load conditions. Automatic capacity controls save power by continuously adjusting output to prevailing load conditions. Exclusive capillary oil return assures uninterrupted oil flow under light loads! All this, in a line that has the broadest range of capacities in the industry —from 18 to 250 tons! All this, in whisper-quiet, vibration-free, lightweight units that require no special foundations or space-consuming structural supports!

For *all* the facts and figures, see your local YORK sales representative...or write York Corporation, York, Pennsylvania, for Catalog EM-213!

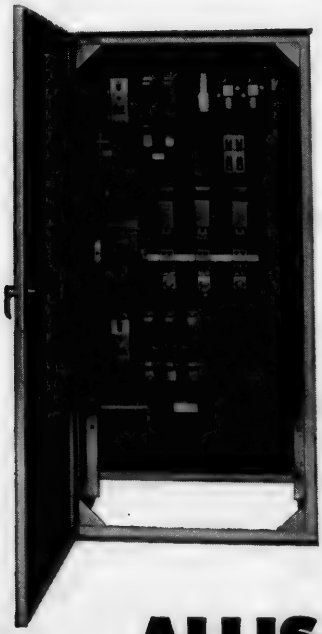
YORK
CORPORATION
SUBSIDIARY OF BORG-WARNER CORPORATION
IN CANADA—SHIPLEY COMPANY OF CANADA, LIMITED

Millions Live Better With YORK... the quality name in air conditioning

Manufacturers of Residential and Commercial Heating and Cooling Systems • Air Conditioning and Refrigeration Equipment for Industrial and Commercial Installations • Room Air Conditioners • Ice Makers • Refrigeration Units and Systems

Rugged* Simplicity

in air-conditioning motor starters



Simple, durable contactors assure continuous service

ONE look reveals the clean, balanced design of Allis-Chalmers contactors. Fewer parts eliminate many potentially troublesome areas — mean less wear. Simple, solid construction and high interrupting capacity are positive assurance of reliability.

For continuous air-conditioning service during peak summer loads, be sure to get the proven dependability of Allis-Chalmers contactors. It is these contactors that make all 600 volt Allis-Chalmers Size 4-8 reduced voltage starters the reliable performers they are.

Call your nearby A-C sales office or distributor for complete information, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

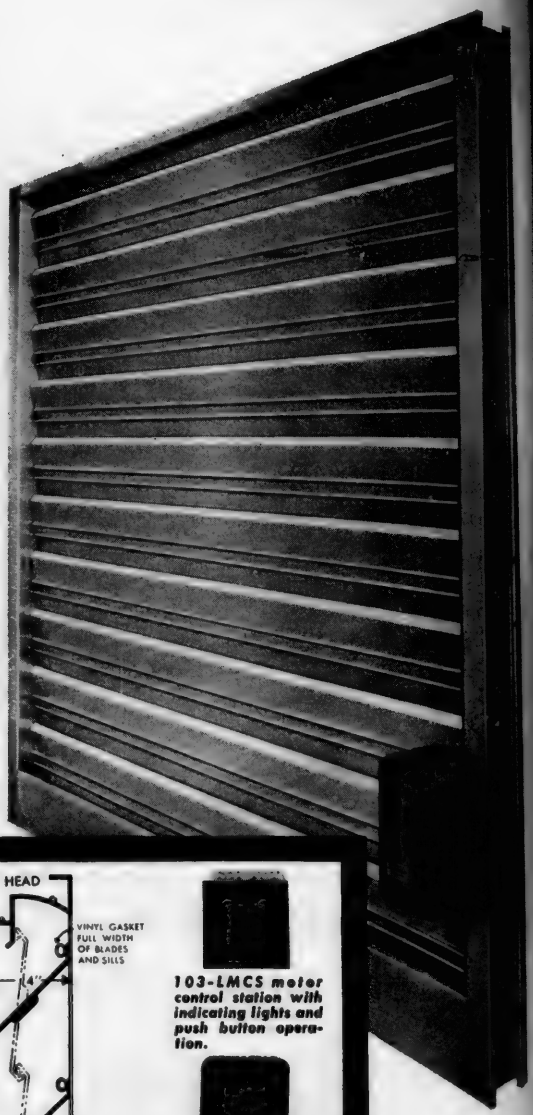
*7th meaning, Webster's New Collegiate Dictionary, Second Edition.

ALLIS-CHALMERS

A-5783

Specify C/S

ELECTRICALLY OPERATED EXTRUDED ALUMINUM LOUVERS



efficient
instant operation of banks of louvers up to 400 square feet from one heavy duty motor.

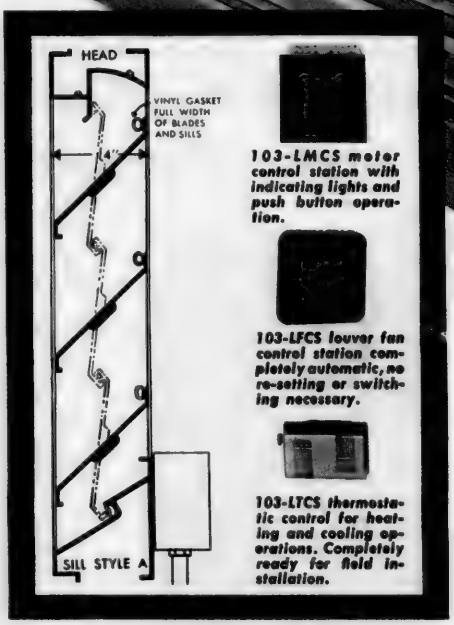
attractive
motor can be placed on either right or left jamb. Screens can be on either front or rear of louver.

reliable
each unit is pre-tested at the factory. No field adjustments or alignment necessary. Each unit is guaranteed for 2 years.

economical
costs are competitive with manual gear operated units controlling banks of louvers and actually cost less than other electric motor control systems.

Specify the EX-110 electrically operated louver on your next job. All electric, the standard EX-110 motor operator operates up to 75 square feet of louver easily with one motor from any desired location. Three types of remote motor controls are available: manual push button control stations; thermostatic station controls and fan control station. All EX-110 components are simple to operate and simple to install. Each EX-110 louver arrives at the job site completely factory tested and assembled; no field adjustments or alignment is necessary.

The EX-110 electrically operated louver is a precision system-engineered product of Construction Specialties, Inc. It is a product you can specify with confidence.


HEAD
VINYL GASKET FULL WIDTH OF BLADES AND SILLS
4"
SILL STYLE A
103-LMCS motor control station with indicating lights and push button operation.
103-LFCS louver fan control station completely automatic, no re-setting or switching necessary.
103-LTCS thermostatic control for heating and cooling operations. Completely ready for field installation.

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HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS

It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✔ Increased air capacity induces rapid system response without wasteful overheating.
- ✔ Separate air and water pumps individually selected to meet actual job requirements.
- ✔ Control system that operates individual pumps only when needed.
- ✔ Flexibility permitting addition of radiation without changing basic pump installation.
- ✔ Low, low, return line connection.

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Fire Protection System Design for an Industrial Plant

J. E. YORK
Consulting Engineer, Harwich, Mass.

The fire protection system to serve an industrial plant consists of a number of important components such as water supply, piping, pumps, sprinklers and controls. Detailed design information is given for each plus reference to important regulations of the fire underwriters and insurance groups. This is Part I of a two-part article.

WHILE an adequate fire protection system for an industrial plant is advisable to obtain satisfactory insurance rates, of even greater importance is the need to prevent fires which may destroy the buildings, cause serious loss to the owners, and economic hardship to employees. Files are filled with accounts of serious conflagrations which have occurred in large manufacturing plants because, for reasons of economy, only partial fire protection was provided.

Therefore, when planning the construction of a new industrial project or additions to an existing manufacturing plant, the fire hazards should be carefully considered by a competent engineer experienced in that field.

The engineer should check all state and local regulations. He should discuss the general arrangement and construction of the project and its operations, insofar as they may affect the fire hazard, with engineers of the Factory Insurance Company, the Associated Factory Mutual Fire Insurance Companies, or other interested fire protection organizations. This should be done in the early planning stages of the project to prevent serious delays in the preparation of plans and specifications, or costly construction changes.

While the owner may sometimes believe the requirements of the insurance organizations are excessive, such demands are based on the combined experience and judgment of a large group of men who have specialized in this field for many years.

Many varied combinations of sprinkler systems and hose streams are possible, but for any of these the following components are essential:

1. An adequate water supply.
2. A suitable piping system.
3. The necessary equipment for effective application of water to the fire when needed.
4. Reliable devices to initiate the operation of fire protection equipment and to give warning in case of fire.

In Figs. 1 and 5, the fire protection systems for two manufacturing plants are shown. Figure 1 shows a plant which consists initially of a small office building and a manufacturing building with anticipated future extensions, as shown in dotted lines. The buildings are located on a lot adjacent to a street with adequate water mains and fire hydrants. The second plant, Fig. 5, consists of a large single story manufacturing building, an office building and its power plant on a large lot adjacent to a river, but set back from the street behind other buildings. Water for fire protection for this plant is to be obtained from the river.

Water Supply

To insure an adequate supply of water, two or more sources of supply are desirable, but in some cases a single source of supply may be approved. An approved source of supply must be capable of furnishing ample water at adequate pressure for a sufficient length of time to extinguish the fire, or keep it in check until more effective supplies can be made available.

1. Public water supply mains.
2. Water tanks.
3. Pumps taking their water from large streams, rivers, reservoirs, lakes, or other large, suitable bodies of clean water.

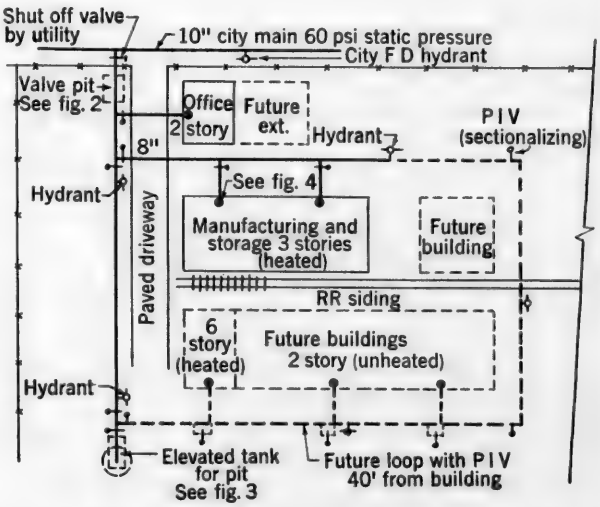

Fig. 1. Fire protection system connected to city mains provided for an industrial plant.

The first and second sources are used for Plant 1 and the second and third for Plant 2.

Water Supply Mains

The capacity and pressure of the public water supply mains should be checked with engineers of the water supply system. Connections to dead end lines or to mains less than 6-inch diameter should not be used.

A shut-off valve must be provided in each connection from the public water supply mains. This is usually furnished and installed by the utility at a spot where it will be accessible without the need of entering the property.

Where there is more than one source of water supply, such as the city water main and an elevated tank as shown in Fig. 1, a check valve must be provided in each connection. Where there is only one water supply connection, a check valve may be required to prevent water circulation. The check valve should be located in a pit as detailed in Fig. 2, where it is accessible for servicing, and a gate valve should be installed ahead of the fire department connection, as illustrated.

Where health authorities require double check valves in a connection between the city water mains and a fire protection system, a spacer from 3 to 5 ft long should be provided between the check valves as shown in Fig. 4 in order to prevent any obstruction in the system from holding the clappers of both check valves open at the same time.

Where meters are required by the utility, special approval must be obtained from the insurance interests, and the meters must be of an approved type.

The NBFU (National Board of Fire Underwriters) Pamphlet No. 13, Sprinkler Systems, Section 3, dealing with water supplies and fire department connections and NBFU Pamphlet No. 24, Outside Protection, Sections 2 and 3 should be referred to for further details.

Elevated Tanks

Elevated water tanks should preferably be installed on independent steel structures supported by suitable foundations.

Where space is not available for a separate supporting structure, approval may be obtained for the location of a tank above the roof of one of the buildings it serves, if properly supported to prevent its collapse in case of a fire in the building.

The smallest tank generally used, has a capacity of

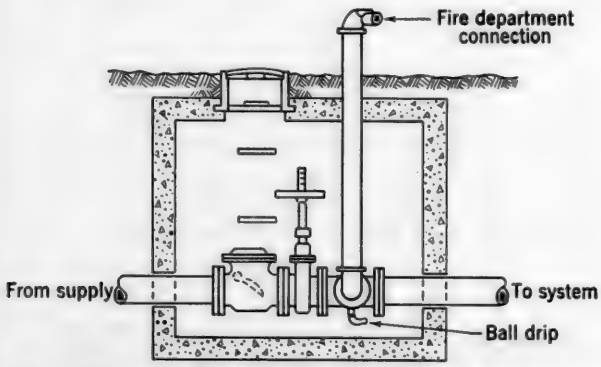

Fig. 2. Pit for gate valve, check valve and fire department connection. Courtesy, NBFU.

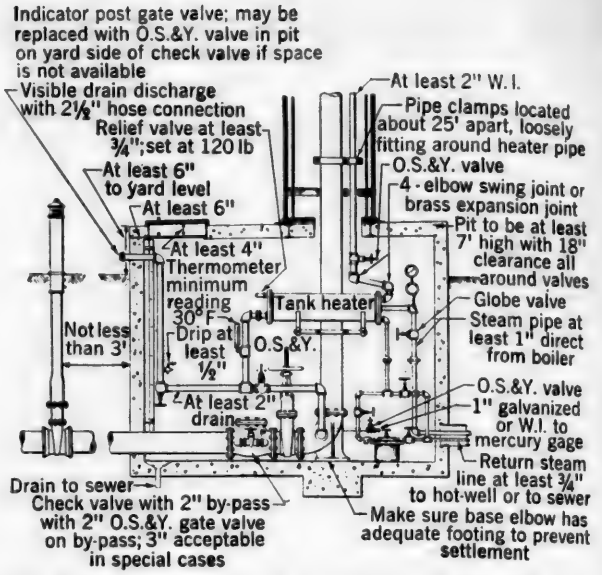
Indicator post gate valve; may be replaced with O.S.&Y. valve in pit on yard side of check valve if space is not available
Visible drain discharge with 2½" hose connection
Relief valve at least ¾"; set at 120 lb
At least 6" to yard level
At least 6"
At least 4"
Thermometer minimum reading 30° F
Drip at least ½"
Not less than 3'
At least 2" drain
Tank heater
O.S.&Y.
At least 2" W.I.
Pipe clamps located about 25' apart, loosely fitting around heater pipe
O.S.&Y. valve
4-elbow swing joint or brass expansion joint
Pit to be at least 7' high with 18" clearance all around valves
Globe valve
Steam pipe at least 1" direct from boiler
O.S.&Y. valve
1" galvanized or W.I. to mercury gage
Return steam line at least ¾" to hot-well or to sewer
Drain to sewer
Check valve with 2" by-pass with 2" O.S.&Y. gate valve on by-pass; 3" acceptable in special cases
Make sure base elbow has adequate footing to prevent settlement

Fig. 3. Valve pit and tank connections at base of riser. Courtesy, National Board of Fire Underwriters.

10,000 gal and various standard sizes are available up to 500,000 gal capacity.

The size of the tank to be provided should be checked with engineers of the insurance association interested in the project, and will be governed by the size of the buildings, their physical location, type of construction, hazards of occupancy, and the type of protection to be provided.

The size of tank to serve sprinklers and hose risers depends primarily on the number of sprinklers that are likely to open during a fire, the number of hose streams which are to be used, and the length of time that it is necessary to supply them with water. The discharge from approved sprinklers having ½ inch orifices or equivalent is as follows:

Pressure at sprinklers, psi	10	15	20	25	35	50	75	100
Discharge, gpm	18	22	25	28	34	41	50	75

Standpipe systems with 2½-inch hose and 1⅛-inch nozzles require 250 gpm capacity for one standpipe, and 500 gpm for two or more standpipes. Standpipe systems with small hose connections only require 70 gpm capacity. An elevated tank should have sufficient storage capacity to supply the system it serves for at least 30 minutes.

Figure 3 shows the connections for an elevated tank for fire protection only, which is filled by manual operation of a valve in the bypass around the check valve at the base of the riser to the bottom of the tank. The check valve and bypass valve can be isolated by closing valves on each side for servicing, without draining the system.

Connections to an elevated tank for combined industrial use and fire protection service are shown in Fig. 6.

As the river water is non-potable, and the tank is not connected to any outlets where water from it may be used for drinking or washing, a separate riser *A*, Fig. 6, may be used as a combined fill pipe and supply for industrial use. Suitable pumping equipment with an automatic control *B* at the maximum water level must be provided to keep the tank filled. Connection *C* at the

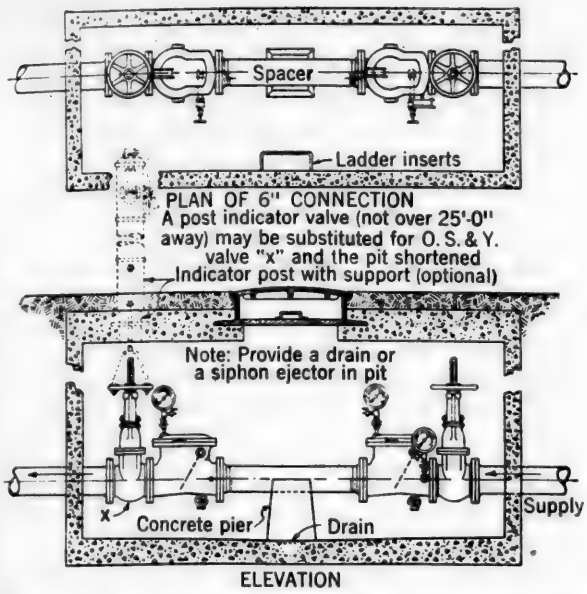
Spacer
Ladder inserts
PLAN OF 6" CONNECTION
A post indicator valve (not over 25'-0" away) may be substituted for O. S. & Y. valve "x" and the pit shortened
Indicator post with support (optional)
Note: Provide a drain or a siphon ejector in pit
x
Concrete pier
Drain
Supply
ELEVATION

Fig. 4. Spacer between two check valves in valve pit.

bottom of the large riser serves only the fire protection system. An overflow pipe *D* should be provided for use in case the automatic control for the pump fails to function properly.

If, instead of the river water, potable water from the public water mains is to be supplied to the combined service tank, a separate fill pipe *E*, terminating above the overflow level should be provided and equipped with a suitable automatic valve to close when the tank is filled, and riser *A* should be used as a supply pipe only for domestic and industrial use.

The overflow pipe must have a capacity not less than the maximum delivery to the tank from its source of supply.

Tank Heating

Tanks must be protected against the possibility of freezing in cold climates. This is usually done by means of a heating unit located in the pit at the base of the tank, as shown in Fig. 3. The heating unit should provide the necessary hot water for a gravity circulation system in the tank, and its riser to maintain a temperature of 40 deg F in the tank during the coldest weather, and should be supplied with steam from a central plant. An independently fired coal, gas or oil burning water heater located above ground adjacent to the tank riser may be used in place of the heater that is usually placed in the pit.

The tank and its heater are generally furnished by manufacturers specializing in this field, and they will furnish the necesary information for the design of a pit or house to accommodate the heating equipment. However, the engineer will have to modify this design to suit piping conditions. The engineer should check the heating requirements for the tank in accordance with information given in Pamphlet No. 22, Water Tanks for Private Fire Protection Service, published by the National Board of Fire Underwriters, or Specifications for Gravity Water Tanks and Steel Towers, as published by the Associated Factory Mutual Fire Insurance Companies.

Pressure Tanks

Pressure tanks are sometimes used as the sole source of supply for a sprinkler system as shown in Fig. 7, or in conjunction with an elevated water tank. If it is planned to use pressure tanks as a source of supply for hose risers, or for any other purpose, approval of the insurance interests must first be obtained.

Pressure tanks range in sizes from 60-inch dia by 20.2 ft long, with a gross capacity of 3000 gal, or 2000 gal of water when two-thirds full, to 96-inch dia by 24 ft long with a gross capacity of 9000 gal or 6000 gal of water when two-thirds full. Where greater capacities are required, multiple tanks must be provided.

The tanks should preferably be installed above the highest sprinklers they serve, but may be located in the basement or elsewhere, subject to the approval of the Inspection Department.

Pressure in the tank when two-thirds full should be not less than 75 psi, if located above the top sprinklers. If the tank is located below the sprinklers, the pressure required may be determined from the following formula:

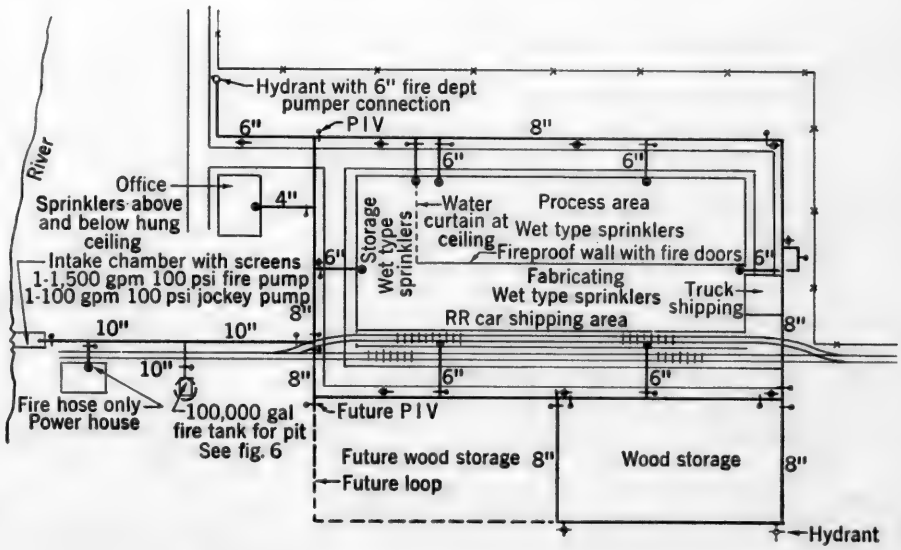

Fig. 5. Fire protection system using river water supply.

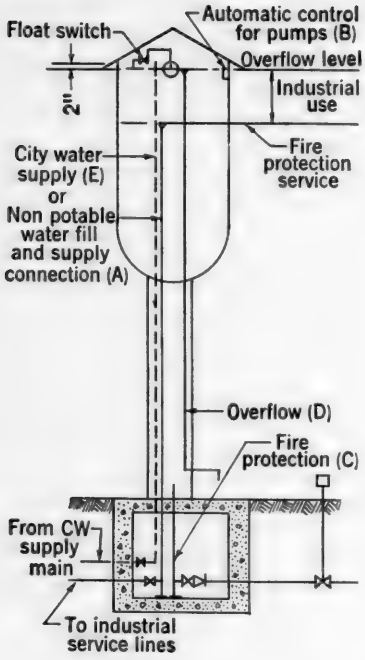

Fig. 6. Elevated tank for combined industrial and fire protection use.

$$P = \frac{30}{A} - 15 + \frac{0.434\ H}{A}$$

where P = Air pressure in the tank, psi gage
A = Proportion of air in the tank
H = Height of highest sprinkler above the bottom of the tank, feet.*

Where pressure tanks are used in conjunction with elevated tanks, a condition of air lock may occur if the piping system is not correctly designed. This may prevent the opening of the check valve on the connection from the elevated tank when the pressure tank is empty. This can generally be prevented in new systems by connecting the two tank discharge pipes together 40 ft or more below the bottom of the pressure tank, and placing the check valve for the supply from the tank at the level of this connection, as shown in Fig. 8.

For further details see Pamphlet No. 22, Water Tanks for Private Fire Protection Service, and Section 3 of Sprinkler Systems Standards of the National Board of Fire Underwriters.

Suction tanks may be used for storage of an adequate supply of water to serve fire pumping equipment where facilities are not available for supplying a sufficient quantity of water directly to the pumps, as shown in Fig. 9. These tanks may be located at only sufficient elevation to insure adequate flow to the pumps until emptied. Fill connections from public water supply systems should be over the top, and suitable overflow connections should be provided, as noted for elevated tanks.

Pumps

The size and type of pumping equipment for fire protection services should be agreed upon with the ones having jurisdiction before proceeding with the purchase of this equipment.

For the direct supply of water to hydrants, hose or sprinkler systems, pumps of special design, called fire pumps, are used. These pumps are built in accordance with the requirements of the National Board of Fire Underwriters, Underwriters Laboratories, Inc., and the inspection department of the Associated Factory Mutual Fire Insurance Companies of Boston.

The pumps may be horizontal centrifugal, or vertical turbine fire pumps driven by motors, turbines, gasoline or diesel engines, or where steam at suitable pressure is constantly available, then by direct acting steam pumps.

Horizontal centrifugal pumps, because of their accessibility, are easier to service. While they generally require less headroom, they demand more floor space. Unless supplied with water from a source which will always insure a positive suction head on the pumps, they must be provided with suitable means for priming. They should never be used with suction lifts exceeding 15 ft.

These pumps are made in two basic types. The first type is a single stage horizontally split casing pump with rated capacities of 500, 750, 1,000, 1,500 or 2,000 gpm, and pressure ranges from 40 to 150 psi gage. Pumps are available with 4, 5, 6 and 8-inch discharge outlets.

The second type for heavier duty is a two-stage pump with rated capacities of 500, 750, 1,000 or 1,500 gpm, and pressure ranges from 100 to 200 psi gage.

The pump is directly connected through a flexible coupling to a driving unit which is mounted on a substantial cast iron base plate. The pump and driver are securely bolted to this plate after careful alignment.

Vertical turbine fire pumps require minimum floor space, but are more difficult to service, as the driving unit must be disconnected, and the pumping unit pulled up for servicing. Because the pump is submerged, no

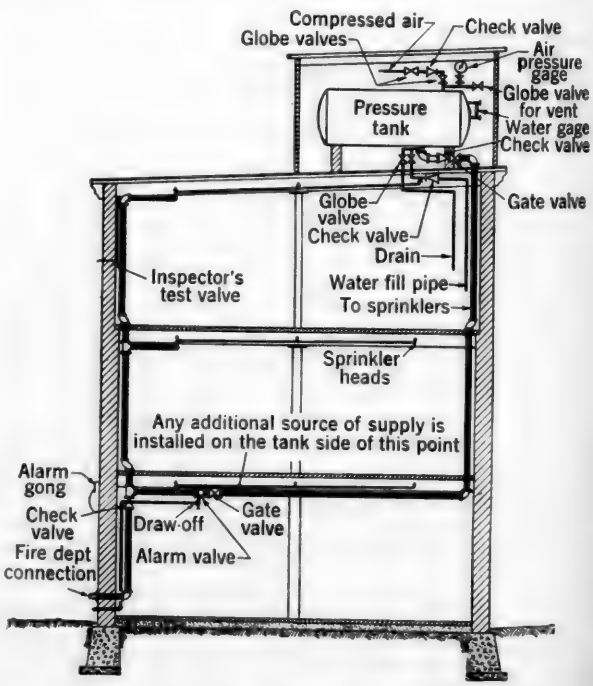

Fig. 7. Cross section of building equipped with automatic sprinklers connected to pressure tank.

* Equation from Section 340, Pressure Tanks, NBFU Pamphlet No. 13 on Sprinklers which gives standards of the National Board of Fire Underwriters.

priming is necessary. These pumps are constructed in accordance with the requirements of the Underwriters Laboratories, Inc. and the National Board of Fire Underwriters, or the Associated Factory Mutual Fire Insurance Companies, Inc. The difference is that the Associated Factory Mutual group requires the use of genuine wrought iron or copper bearing steel column pipe in the construction of the pump.

Pumps of this type with vertical motor or gasoline drive are available in capacities from 500 to 2500 gpm at pressures of 100 psi gage or more at the discharge, as required. The nominal speed of the pumps must not exceed 1760 rpm and the number of stages will depend on the pressure to be maintained. The pump must be sufficiently submerged for reliable operation. With a wet pit installation, the second impeller from the bottom must be below the lowest standing water level in the open body of water supplying the pit. For a well installation, the pump bowls should be 10 ft below the pumping level at 150% of normal capacity.

Gasoline or diesel engine driven fire pumps should only be used as supplemental units, or where other sources of power are not dependable or available. Their use with automatic starting equipment as the sole source of supply for a sprinkler system is not approved by authorities.

The following attachments should be provided unless their omission is specifically approved:

1. Automatic air release.
2. Circulation relief valve.
3. Eccentric tapered reducer at suction inlet of horizontal pumps.
4. Hose manifold with hose valves.
5. Pressure gages.
6. Priming connections for horizontal pumps except where the pumps are always under a positive suction head.
7. Relief valve and discharge cone.
8. Splash shield between pump and motor if open frame motor is used.
9. Test valves with piping connections.

Characteristic curves of the pumps should be submitted. The pumps should furnish not less than 150% of rated capacity at a pressure not less than 65% of rated pressure.

The shutoff pressure for horizontal pumps should not exceed 120% of the rated pressure and for vertical shift pumps not more than 140% of rated pressure.

These pumps must be constructed in accordance with the specifications for Underwriter steam fire pumps as published by the Associated Factory Mutual Fire Insurance Companies.

For reliability of operation, duplex pumps of four standard sizes are used; capacities are 500, 750, 1,000 and 1,500 gpm with piston speeds from 140 to 160 fpm. As the ratio of the area of steam to water cylinders varies from 4 to 1 for the smaller sizes and 2¾ to 1 for the largest sizes, suitable water pressures may be obtained for general fire protection needs.

Such pumps are not suitable for use with steam at temperatures in excess of 400 deg because of difficulty with lubrication of the slide valve. Steam and exhaust ports, water passages and valves are oversize to allow higher operating speeds and greater water delivery than

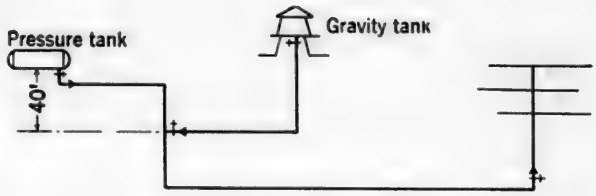

Fig. 8. Arrangement of valves where pressure and gravity tank risers are connected together to avoid air lock. Courtesy, National Board of Fire Underwriters.

for other pumps, without water hammer. Special cushion exhaust ports are provided on the steam cylinders to prevent the piston from striking the cylinder head if the load is suddenly taken off with the pumps running at full speed.

All working parts of the pump must be of rustproof construction to insure instant starting after long periods of idleness. The pump should be provided with suction and discharge air chambers, hose test valves corresponding to the capacity of the pump, and a relief valve ahead of the discharge valve on the pump.

For special conditions, such as a sprinkler system for the upper floors of an addition to an existing group of buildings, as shown in Fig. 1, in which adequate pressure is not available from the existing fire protection system, and where the expense of the installation of an Underwriter's approved fire pump cannot be justified, a special fire service pump may be installed to boost the pressure in the system.

These pumps must be specifically approved for fire service. They should be of the horizontally split case type with normal capacities of 200, 300 or 450 gpm with pressure boosts from 40 to 100 psi. They are limited to a maximum of 30 hp and at zero lift the maximum capacity shall not exceed 130% of the rated capacity. The pump casing shall be designed to withstand a hydrostatic pressure of not less than 250 psi.

The pump, motor and controller should be purchased under one contract, and characteristic curves should be furnished for the pump.

In order to maintain the pressure in a system supplied by a fire pump, a small pump called a jockey pump may be provided. This pump should have a capacity of 20 to 100 gpm to make up losses due to leakage in the piping system, and should be of horizontal or vertical type as supplied for the fire pumps. The pump should start and stop under automatic control and should be set so that it will operate with only a slight pressure drop in the system.

For further information on pumps for fire protection service, the reader should refer to NBFU 20 and 21 standards for the Installation of Centrifugal Pumps and Steam Fire Pumps.

Piping System

The sources of water supply, whether public water mains, an elevated tank, pumps, or combination of these, must be connected through a piping system to supply hydrants for outside protection, and sprinklers or hose for inside protection.

Underground Protection

Underground pipe should be cast iron or approved

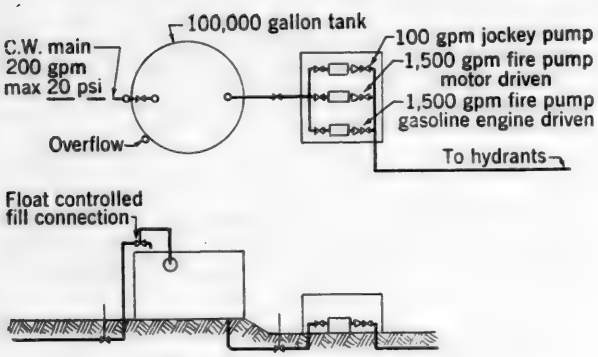

Fig. 9. Suction tank and pumps.

asbestos cement pipe. For pressures not exceeding 150 psi, Class C or Class 150 pipe should be used. For higher pressures, or locations where access to the pipe is difficult, heavier piping should be used.

Bell and spigot end pipe with poured lead joints properly caulked, are commonly used but they require strapping at ends of the line or changes in direction. Special joint compounds or mechanical type joints may be used, but approval should first be obtained from the authority having jurisdiction. Several self-caulking, self-sealing compounds for making joints are available. The method of pouring them is similar to that for lead joints, but as they do not contract like lead when cooling, caulking is not necessary. It is common experience that when water is first turned on in lines with such joints, the joints will weep or leak. After the water has been in the pipe for a few days the joints will tighten up and leakage will cease.

No pipe less than 6-inch diameter should be used in yard systems for mains or hydrant branches. For a small project which may be enlarged later, as shown in Fig. 1, a loop may not be required for the initial installation, but provision should be made for it to be installed when more buildings are added.

Piping should be buried at sufficient depth to afford protection against freezing, and reliable records should be consulted for determining the required depth. Not less than 3 ft of cover under driveways, or 4 ft under railroad tracks should be provided for protection against superimposed traffic loads.

A shut-off valve must be provided on each connection to a building, and at suitable locations for sectionalizing the underground system. Post indicator valves should preferably be used, and should be located not less than 40 ft from the building protected, if possible. Where this is not practicable, the valve may be located closer to the building if it is opposite a blank section of the building wall, or if a building has no basement and there is no suitable outside location for the valve. A short post indicator valve may be installed in a riser with the handwheel projecting through the outside wall.

A separate underground connection should be provided for each sprinkler riser in the building, and should be at least as large as the riser. Where there is a possibility of settlement of the building, or settlement of filled land adjacent to a building on piles, swing connections or flexible joints should be placed on the supply pipe close to the building.

Hydrants should preferably be located about 50 ft from the buildings they protect and not more than 300 ft apart. In no case should the use of a hose line more than 500 ft long be required for the protection of any important building. The underground piping system should be flushed clean before connecting to the piping in the building.

Hydrants and Post Indicator Valves

Hydrants should be of a type approved by the Underwriters Laboratories with a 6-inch connection to the underground piping system, a 5-inch bottom valve, a 6-inch riser barrel and not less than two 2½-inch hose outlets. Hose outlet threads should conform to the local fire protection standards. Outlets should be provided with caps chained to the hydrant, and may be equipped with independent 2½-inch gate valves, if desired. Hydrants should be designed to remain closed in case of breakage, and if the soil conditions are suitable, should drain automatically when closed. Where located in wet ground or where they cannot be drained, the drain connection should be plugged and provision made for pumping out the barrel in cold weather.

The construction of the hydrant should permit repairs or replacement of working parts without digging up the barrel. Provision should also be made for replacement of a section of the barrel in case of breakage, or for insertion of a new section, in case of change of grade. In some locations frost protection casings may be required to protect against frost upheaval. Where hydrants are liable to frequent breakage because of their location, heavy guard posts should be placed around them for their protection.

Sectionalizing and shut-off valves for underground piping should preferably be of the indicator post type, with the top of the post about 36 inches above the ground. Provision should be made for the attachment of the necessary equipment where a supervisory system is to be provided to give warning in case of unauthorized closing of these valves.

Interior Piping

Piping inside a building serving sprinklers or hose for water pressures up to 300 pounds psi should be standard weight black steel pipe, in accordance with American Standard B 36.10 Wrought Steel and Iron Pipe.

The piping generally is not galvanized, but it is painted on the outside. Galvanized piping, however, may be required where moisture conditions are very severe, but corrosive fumes are negligible.

Screwed cast iron or malleable iron and flanged cast iron fittings with screwed flanges should generally be used, but in special cases permission may be granted for welding joints in risers and large mains.

Screwed fittings should be designed for a cold water working pressure of 175 psi and for sprinkler service. Flanged fittings and flanges should conform to the 125 lb American Standard.

Coming Next Month

The second part of this article by J. E. York to be published in the October issue will deal with the various types of sprinkler systems, water application equipment, and some of the devices that are used for fire detection.

Psychrometric Data are Tabulated for

Convenient Selection of Package Units

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When the cooling estimate does not match available air conditioning package capacities, which unit should be chosen? With psychrometric data conveniently arranged, recalculation is rapid and accurate, and the proper choice is easily made.

THE growing application of package air conditioning units to increasingly larger size installations warrants some attention to the arrangement of psychrometric data to facilitate selection. While the manufacturers of these units are making available to the application engineer an ever greater selection of capacities, it is seldom that an estimate of cooling load exactly corresponds to one of the package capacities offered. It is then that the engineer must decide whether to select the next higher or the next lower capacity unit available.

To facilitate this selection, the author has calculated and arranged in convenient form those psychrometric data that are needed. Table 1 gives values of relative humidity, dew point, and grains of moisture per pound of dry air for various room design values of dry bulb and wet bulb temperature. Values of relative humidity, dew point, and grains of moisture per pound of dry air corresponding to outside dry bulb and wet bulb temperatures for almost all of the continental United States are given in Table 2.

Table Follows ET Curve

In deciding upon the range of dry bulb and wet bulb temperatures to be included in Table 1, the author was mindful of the fact that clients are demanding lower Effective Temperatures than they did in the past. A 1916 handbook on illumination, published by Edison Lamp Works of General Electric Co., Harrison, N. J., recommended an illumination intensity for offices of from 4 to 8 foot candles. Today, intensities from 60 to 100 foot candles are the norm. In the same way, the industry-recommended values of 80 deg F db and 50% rh are becoming obsolete. On a hot day, and not necessarily too humid a one, clients with 80-deg temperature in their offices may complain that their air conditioning is not working right.

As a consequence, lower design values of dry bulb temperatures are being used. Some clients are already asking why 70 or 72-deg temperatures are not used, the same as in winter, and there is little success in trying to advise clients of the shock of going from a conditioned space at 70 deg to the outside at 95 deg when in so many instances they do not leave the conditioned space for hours at a time. The author believes that presently a design condition of 75 deg db and 62 deg wb, corresponding to a relative humidity of 48%, should be considered. The Effective Temperature at this condition, 70 deg, is one at which, according to the ASHAE *Guide*, 90% of the people are comfortable. However, values corresponding to lower Effective Temperatures are included in the table for the cases where clients request still lower temperatures.

By scanning areas of Table 1 adjacent to that point of the table representing the ideal design condition, it is readily seen how small changes in design conditions effect heat gain or loss. For instance, if it is desired to use design values of 75 deg db, 62 deg wb, the relative humidity is seen to be 48%. An increase of one degree in wet bulb temperature will raise the relative humidity to 51.6%, the grains of moisture to 68; and a further increase of one degree in wet bulb temperature will result in 55.2% rh and 71.8 grains of moisture per pound of dry air. While the higher moisture content will decrease the refrigeration load, the relative humidity might be objectionable.

Derivation of Tabular Values

Some readers may wish to extend either Table 1 or Table 2 to cover conditions outside the scope of this article. For this purpose, the following derivation of one set of values will illustrate how this may be done.

Given: 76 deg db, 63 deg wb.

To Find: Humidity ratio, dew point, relative humidity.

The humidity ratio, W, can be computed from the Carrier[1] equation:

$$W = \frac{r'W' - C_{pa}(t - t')}{r' + C_{ps}(t - t')}$$

where

W = weight of water vapor, lb per lb dry air, at t,
W' = weight of water vapor, lb per lb dry air, at t',
t = dry bulb temperature, deg F,
t' = wet bulb temperature, deg F,
r' = latent heat of vaporization at t', from steam tables,
C_{pa} = mean specific heat of air at constant pressure between t and t',
C_{ps} = specific heat of steam at constant pressure at t, $= 0.4423 + 0.00018t$.

The value of r' is found in Table 1, *Thermodynamic Properties of Steam*,[2] by Keenan and Keyes, to be 1058.2. From the 1958 *Guide*,[3] Chapter 3, Table 2, W' is seen

Table 1—Inside Design Conditions

Dry Bulb Temperatures		Wet Bulb Temperatures																			
		58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
70	RH	48.3	52.2	56.1	60.1																
	DP	49.6	51.7	53.6	55.5																
	GR	52.8	57.1	61.4	65.9																
71	RH	45.3	49.0	52.8	56.7	60.6															
	DP	48.8	50.9	52.9	54.8	56.7															
	GR	51.2	55.4	60.0	64.2	68.8															
72	RH		46.1	49.7	53.4	57.3	61.2														
	DP		50.1	52.2	54.2	56.1	57.9														
	GR		53.9	58.2	62.7	67.2	71.9														
73	RH			46.7	50.4	54.0	57.7	61.7													
	DP			51.4	53.5	55.4	57.3	59.1													
	GR			56.6	61.0	65.6	70.3	75.0													
74	RH				47.5	51.0	54.7	58.4	62.2												
	DP				52.8	54.7	56.1	58.5	60.2												
	GR				59.4	64.0	68,6	73.4	72.2												
75	RH				44.6	48.0	51.6	55.2	58.9	62.7											
	DP				52.0	54.0	56.0	57.9	59.6	61.4											
	GR				57.8	62.4	68.0	71.8	76.6	81.6											
76	RH					45.3	48.8	52.2	55.7	59.4											
	DP					53.3	55.3	57.2	59.1	60.8											
	GR					60.8	65.4	70.2	75.0	80.0											
77	RH					42.7	46.0	49.4	52.8	56.3	59.8										
	DP					52.6	54.7	56.6	58.5	60.3	62.0										
	GR					59.1	63.8	68.6	73.4	78.3	83.3										
78	RH						43.5	46.7	50.0	53.4	56.8	60.3									
	DP						54.0	56.0	57.9	59.7	61.4	63.2									
	GR						62.2	67.0	71.7	76.7	81.8	86.9									
79	RH							44.1	47.3	50.5	53.9	57.3	60.8								
	DP							55.3	57.2	59.1	60.9	62.6	64.3								
	GR							65.3	70.1	75.1	80.2	85.3	90.6								
80	RH								44.6	47.8	51.1	54.5	57.8	61.2							
	DP								56.6	58.5	60.3	62.1	63.8	65.5							
	GR								68.5	73.5	78.5	83.7	89.0	94.4							
82	RH									42.9	45.9	49.1	52.3	55.5	58.5	62.1					
	DP									57.3	59.1	61.0	62.8	64.5	66.2	67.8					
	GR									70.2	75.3	80.5	85.9	91.1	96.7	102.4					
84	RH											44.2	47.2	50.2	53.3	56.4	59.6				
	DP											59.9	61.7	63.5	65.2	66.8	68.4				
	GR											77.2	82.5	87.9	93.4	99.1	104.9				
86	RH													45.4	48.3	51.2	54.2	57.4	60.4		
	DP													62.4	64.2	65.9	67.5	69.2	70.7		
	GR													84.6	90.2	95.8	101.6	107.6	113.7		
88	RH															46.4	49.3	52.2	55.2	58.2	61.2
	DP															64.9	66.6	68.3	69.9	71.4	73.0
	GR															92.6	98.3	104.3	108.4	116.5	122.9

Wet Bulb Temperatures

Table 2—Outside Design Conditions

Dry Bulb Temperatures		Wet Bulb Temperatures																			
		64	65	66	67	68	69	70	72	73	74	75	76	77	78	79	80				
85	RH	31.0	33.6			41.9															
	DP	51.0	53.2			59.3															
	GR	55.7	60.5			75.6															
90	RH		25.0	27.3		32.0		37.0		44.8											
	DP		49.4	51.8		56.2		60.2		65.7											
	GR		52.5	57.4		67.50		78.1		95.1											
93	RH		20.7							38.7		43.6									
	DP		46.9							64.2		67.7									
	GR		47.70							90.2		102.2									
95	RH	16.3	18.2		22.2			28.4		35.1		40.0	42.3		47.3	49.8	52.6				
	DP	42.2	45.1		50.4			57.2		63.2		66.8	68.5		71.8	73.4	74.9				
	GR	39.8	44.52		54.4			70.10		86.9		99.0	105.7		117.9	124.5	131.4				
98	RH												36.8	39.1	40.7						
	DP												67.1	68.9	70.5						
	GR												100.2	106.5	112.9						
100	RH						19.8	21.7	25.4		29.5	31.5	33.6		37.9		42.4				
	DP						51.5	53.9	58.4		62.5	64.4	66.2		69.7		73				
	GR						56.8	62.0	73.1		84.8	90.8	96.9		109.7		123.2				
105	RH							16.3	19.6		23.0		26.5								
	DP							50.2	55.2		59.7		63.7								
	GR							54.1	65.1		76.7		88.8								

All temperatures are degrees F.
RH = Per cent Relative Humidity
DP = Dew Point temperature
GR = Grains moisture per pound dry air

PSYCHROMETRIC DATA FOR INSIDE AND OUTSIDE DESIGN CONDITIONS IN USUAL U.S. PRACTICE

to be 0.01235 lb. The same table can be used to get very good approximations of C_{pa} by subtracting two values of enthalpy in one-degree increments at both t and t', and averaging; in this case the two are identical, 0.240. Substituting the foregoing into the Carrier equation, the value of W is found to be 0.009348.

From Table 2 of the *Guide*, cited above, the temperature corresponding to $W = 0.009348$ is 55.3 deg, by interpolation, which is the dew point of the air-vapor mixture. The pressures, in inches of mercury, corresponding to 55.3 and 76 deg are 0.44113 and 0.90470. The relative humidity, then, is rh $= p/p_s$

where,

p = pressure corresponding to the dew point temperature,

p_s = pressure of saturated vapor at t.

Dividing 0.44113 by 0.90470, gives a relative humidity of 48.8%. Grains per pound of dry air are obtained by multiplying the value in pounds by 7,000; $0.009348 \times 7{,}000 = 65.4$.

Using the Tables

A hypothetical case is chosen to illustrate the use of Tables 1 and 2. Design conditions are as follows:

	Given		From Tables 1 and 2		
	db	wb	% rh	dp	gr per lb
Outside	95	75	40.0	66.8	99.0
Room	76	63	48.8	55.3	65.4
Difference	19				33.6

Outside air: 1500 cfm
Infiltration: 150 cfm
By-pass factor: 0.15

Solar, transmission, and internal heat, sensible	183,800 Btu per hr
Infiltration, sensible	3,000
Bypassed outside air, sensible	4,600
Total room sensible heat	191,400
People latent load	20,000
Infiltration, latent	3,400
Bypassed outside air, latent	5,200
Total room latent heat	28,600
Total room heat	220,000
Outside air, sensible heat	26,000
Outside air, latent heat	29,000
Total outside air	55,000
Grand total heat	275,000 Btu per hr
or,	22.5 tons

Shall a 20-ton or 25-ton package unit be furnished? Selection of a 20-ton unit, rated to give 240,000 Btu of cooling, would mean that 35,000 Btu of estimated cooling needs would have to be eliminated. Unless a decrease in the amount of outside air is permissible, the decrease would have to come from a rise in the room dry bulb and wet bulb temperatures, and the question is, by how much? Since Table 1 has all the psychrometric data conveniently arranged, a number of rapid recalculations based on tabular values in the neighborhood 76 deg db and 63 deg wb can be made, with the result that a rise to 80 deg db and 68 deg wb (and 54.5% rh) is seen to be necessary. As this condition is not satisfactory, the choice of a 20-ton unit is rejected.

What will be the room conditions if a 25-ton unit is selected? The unit has a capacity of 25,000 Btu per hr above the 275,000 Btu per hr estimated load. Room temperature and humidity may be lowered, or the quantity of outside air can be increased, or some of each can be considered. If we assume that 100 people are to be accommodated in the conditioned space, for whom 1500 cfm of outside air was provided, and that some of these people will be smoking, it is preferred to increase the ventilation air to, say, 2,000 cfm. This changes the cooling estimate as follows:

Total room sensible heat gain	192,800 Btu per hr
Total room latent heat gain	30,300
Total room heat gain	223,100
Outside air heat gain	73,000
Grand total heat gain	296,100 Btu per hr
or	24.7 tons

a load which the 25-ton unit will handle nicely.

References

1. This formula is found in a paper entitled "Rational Psychrometric Formulae" presented to the American Society of Mechanical Engineers, 1911, by Dr. Willis H. Carrier.

2. Thermodynamic Properties of Steam, Joseph H. Keenan and Frederick G. Keyes, published by John Wiley & Sons, Inc.

3. Heating, Ventilating, Air Conditioning Guide, 1958 Edition, published by the American Society of Heating and Air-Conditioning Engineers, Inc.

Centigrade is a Misnomer

Over two centuries ago the Swedish astronomer Anders Celsius chose the melting point of ice as one end of his temperature scale and the boiling point of water as the other. Because the interval between the points was divided into 100 equal parts, or degrees, the temperature scale was called *Centigrade*, which means divided into one hundred degrees.

At a meeting preliminary to the Ninth General Conference on Weight and Measures, 1948, it was suggested that the triple point of water, which is 0.01 degrees Centigrade, is a better fixed point than the ice point. If assigned a definite value, it could serve as the basis of the thermodynamic scale, a desirable feature from the theoretical viewpoint, but a problem in semantics arises.

The problem is explained by R. D. Thomson, writing in the May, 1957 issue of ASTM *Bulletin*. If the triple point were to replace the ice point, he points out, the fundamental interval between it and the steam point is 99.99 degrees, *not* 100 degrees. Therefore, Centigrade is a misnomer. The Ninth General Conference adopted the name Celsius to avoid the contradiction.

The National Bureau of Standards has adopted the new name, though its acceptance in the United States has been slow. In Europe, the term *Celsius* is now quite common. The ASTM subcommittee on thermometers has been asked to adopt the change and promote it.

Operation of Centrifugal Pumps

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Part I of a two-part article that covers not only the normal recommended procedures of starting, operating and stopping centrifugal pumps, but also deals with the various problems introduced by operation under so-called abnormal conditions. Pump priming is discussed.

CENTRIFUGAL pumps are generally selected for a given capacity and total head when operating at rated speed. These characteristics are referred to as "rated conditions of service" and, with few exceptions, represent those conditions at or near which the pump will operate the greatest part of the time. As a result, it is desirable that the pump efficiency be at its maximum under these conditions of service and the pumps are so selected wherever possible.

There are, however, a multitude of services and applications which require the pump to operate at capacities and heads differing considerably from the rated conditions. Such, for instance, are applications for steam power plant services, where boiler feed, condensate and heater drain pumps may be called upon to deliver any flow to the boiler from full capacity to zero, depending upon the load carried at the moment by the turbo-generator. Condenser circulating pumps are subject to somewhat lesser variations, but nevertheless these pumps may have to run against widely varying total heads and, hence, at varying capacities. General service pumps in a variety of applications may likewise be called upon to operate over a very wide range of flows. It is very important, therefore, that the user of centrifugal pumps acquaint himself with the effects of operating pumps at capacities and heads other than the rated conditions and with the limitations imposed upon such operation by hydraulic, mechanical or thermodynamic considerations.

Operation of Centrifugal Pumps at Reduced Flows

If a volute pump is operated at other than its design capacity, there results a certain unbalance of the hydraulic forces acting radially on the impeller. The maximum unbalance occurs at zero-capacity. This unbalance creates a radial load on the shaft of the pump. In some cases, even with single stage pumps, shaft failures have occurred because part-capacity operation was not contemplated for by the designer and the pump shaft was not suitable for maximum loading over the entire operating range of the pump.

The radial thrust is definitely a function of the head generated and, therefore, its effect is negligible for single stage pumps of average size and limited pressures. As the total head generated and the pump size increases, means have to be employed to eliminate or counteract this radial thrust, so as to avoid the need of extremely large diameter pump shafts and oversize bearings.

One of the means used to combat the effects of radial thrust in volute type pumps is the dual-volute construction. This, in effect, means using two half-capacity volutes, each taking its flow from a 180 deg discharge arc of the impeller. Of course, the dual-volute cannot eliminate the radial thrust of a single stage pump entirely, since one of the volutes discharges into a straight discharge nozzle while the second discharges into the curved channel formed by the first volute. While in general dual-volute pump designs can be safely operated at low flows for extended periods, any limitations as to minimum capacity imposed by the manufacturer should be strictly followed.

There is another problem that arises from the operation of a centrifugal pump at extremely reduced flows. It is the thermodynamic problem caused by heating of the liquid handled by the pump. The difference between the brake horsepower consumed and the water-horsepower developed represents the power losses within the pump itself, save for a small amount lost in the pump bearings. These power losses are converted into heat which is transferred to the liquid passing through the pump.

If the pump is operating against a completely closed valve, the power losses are equal to the brake horsepower at shut-off and since no flow takes place through the pump, all this power goes into heating the small quantity of liquid contained within the pump casing.

As this process occurs, the pump casing itself heats up and a certain amount of heat is dissipated by radiation and convection to the surrounding atmosphere. If the amount of heat added to the liquid is small, it can be transmitted through the casing with a low differential in temperature between the liquid in the casing and the outside air. On the other hand, if the power loss is very high, the liquid temperature might have to reach an exceedingly high value, far in excess of the boiling temperature at suction pressure, before the amount of dissipated heat equals that generated in the pump proper. Operation of the pump under such conditions would have disastrous effects.

Rate of Heating

Very obviously the rate of heating of the liquid in the pump casing for a given power loss depends both upon the volume of the casing contained in the casing and upon the surface of casing available for heat dissipation. For instance, if the total amount of power losses is 100 Btu per second (141 hp) and if the pump contains 100 lb of water, the water temperature will increase at the rate of 1 deg F per second or 60 deg per minute. Operation at shut-off under those conditions is highly dangerous. But if the pump in question is a low head high capacity unit and contains 5,000 lb water, the rate of temperature increase will be only 0.02 deg per second or a little over one degree per minute—hardly serious if the operation is not prolonged.

If flow is taking place through the pump, conditions become stabilized, and for any given flow it is possible

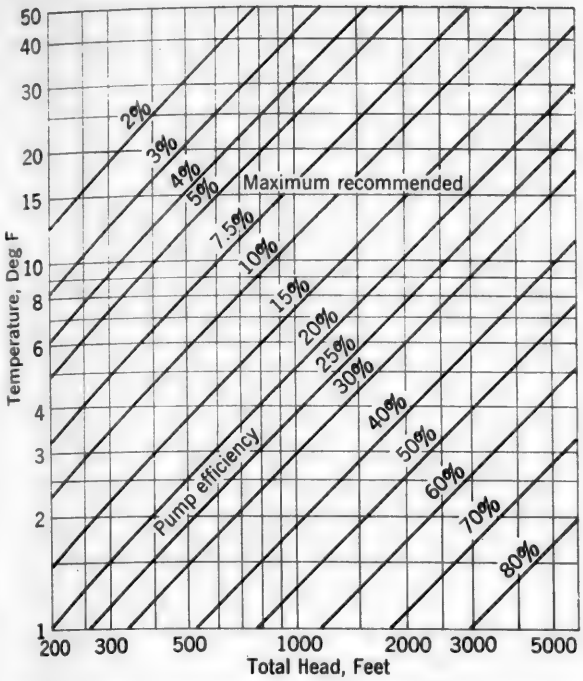


Fig. 1. Chart of temperature rise in centrifugal pumps in terms of total head and pump efficiency.

to calculate the amount by which the temperature at the discharge will exceed the suction temperature. This rise is determined by multiplying the difference between the brake horsepower and the water-horsepower by 2545 (Btu equivalent of one horsepower-hour) and thus determining the total heat imparted to the liquid in Btu. Assuming that the liquid is water (specific heat = 1 Btu per lb per degree), this total heat is divided by the flow in pounds per hour and yields the temperature rise in degrees F.

$$\text{Degrees rise} = \frac{(\text{Brake Hp} - \text{Water Hp}) \times 2545}{\text{Capacity in lb per hr}}$$

A more readily used formula relates the temperature rise to the total head and to the pump efficiency:

$$\text{Degrees rise} = \frac{\text{Total head in feet}}{778}\left(\frac{1}{e} - 1\right)$$

where e = the pump efficiency at the capacity involved.

Graphical Solution

Figure 1 gives a graphical solution of this formula and permits, in addition, one to determine the minimum permissible operating capacity, once the maximum permissible temperature rise has been selected. When liquids other than water are handled by the pump, it becomes necessary to correct the resulting answer for the difference in the specific heats of the liquids.

The chart can be used to plot a temperature rise curve directly on the performance curve of a centrifugal pump, as shown in Fig. 2, which represents the characteristics of a boiler feed pump designed to handle 550 gpm of 250 deg feedwater against a total head of 1800 ft. It will be noted that the temperature rise increases very rapidly with a reduction in flow. This is caused by the fact that the losses at low deliveries are greater while the flow of liquid which must absorb the heat developed in the pump is low. For instance, it will be seen from Fig. 2 that for a capacity of 50 gpm, the temperature rise is 17 deg while at the full capacity of 550 gpm it is less than one degree.

If the pump is fitted with a balancing device, a certain portion of the suction capacity is returned either to the pump suction or to the suction supply vessel. The discharge capacity does not in such a case represent the true flow through the pump. The formula for the temperature rise and the chart on Fig. 1 can still be used, provided a correction is made to take care of the increase in pump flow representing the balancing device leak-off.

Calculation of Flow

Inasmuch as the temperature rise varies with the pump capacity, the minimum permissible capacity from the thermodynamic point of view will actually depend on the maximum permissible temperature rise. The latter varies over a wide range, depending upon the type of installation. In the case of hot water pumps—such as,

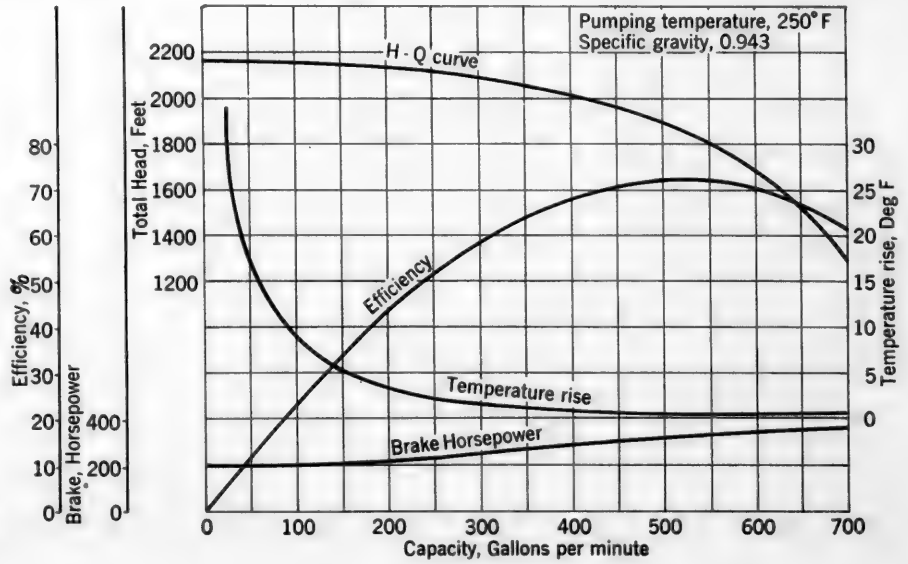
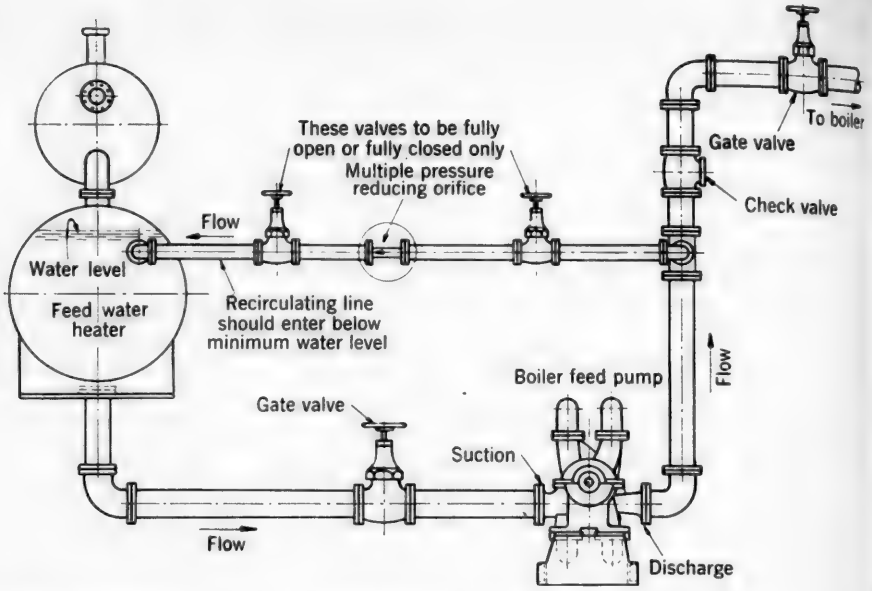


Fig. 2. Typical performance curve of a centrifugal pump on which the temperature rise is also indicated.

Fig. 3. Arrangement of bypass recirculation for boiler feed service.



for instance, on boiler feed service—it is generally recommended to limit the temperature rise to about 15 deg. There are several convenient rules-of-thumb for calculating minimum permissible capacities. For instance, on boiler feed service, a minimum flow of 30 gpm per 100 bhp at shut-off will hold the temperature rise to the recommended 15 deg. On general service pumps, where the permissible temperature rise may vary depending on the service, the operating temperature and the size of the pump, the minimum flow is given in gallons per minute by the following formula:

$$Q \text{ minimum in gpm} = \frac{6.0 \times \text{BHP at shut-off}}{\text{Permissible temperature rise in deg. F}}$$

When the centrifugal pump handles cold water, the temperature rise may be permitted to go higher, up to 50 or even 100 deg. The minimum capacity is then established as that capacity at which the temperature rise corresponds to the maximum rise permitted.

If the service is such that the pump may be required to operate at shut-off or at extremely low flows, some means must be provided to prevent operation at flows below the minimum permissible, regardless of whether the discharge valve or the check valve is closed. This is accomplished by installing a bypass in the discharge line from the pump, located on the pump side of the check and gate valves and leading to some lower pressure point in the installation where the excess heat absorbed through operation at light flows may be dissipated. Under no circumstances should this bypass be led directly back to the pump suction, as there would be no means to dissipate the excess heat and the entire purpose of the bypass arrangement would be defeated and the time spent in making the bypass would be wasted.

In the case of boiler feed pump installations, where the pumps take their suction from the deaerating heater, the logical place to return the recirculation flow is the heater itself, as shown in Fig. 3. Since the water in the

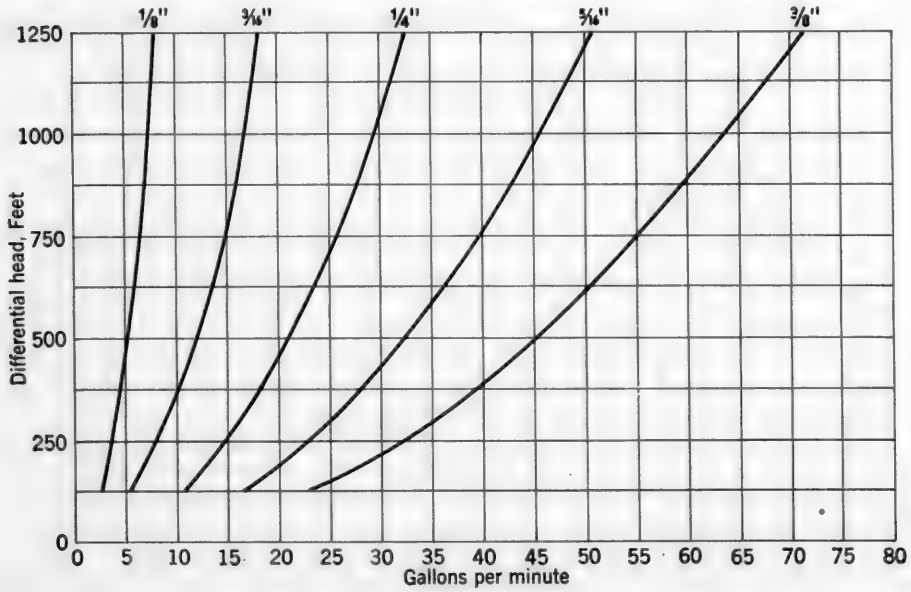


Fig. 4. Flows through single orifices drilled in a stainless steel rod.

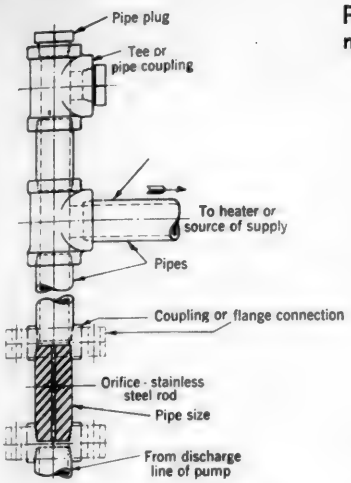


Fig. 5. Piping arrangement and details for a bypass orifice.

bypass line is under a pressure equal to the pump discharge pressure, it becomes necessary to locate an orifice in this line such that it will limit the flow through the line to the desired value. When the differential pressure broken down by the orifice is low, a single drilled orifice in a stainless steel rod of 3-inch to 6-inch in length can be used. Figure 4 shows the flows through orifices of various diameters and with various head differentials.

To avoid damage to the piping in which such an orifice is installed, elbows should not be located too close after the orifice. If piping must effect a turn, the orifice should first be followed by a length of straight pipe of at least 12 to 18-inch. After this, a tee should be provided, as shown in Fig. 5, to lead back to the heater. The dead end of the tee should then be followed by another length of straight pipe, terminating in a pipe coupling. The end of the pipe coupling should be fitted with a stainless steel plug, which will take the brunt of the high velocity stream coming through the orifice. The plug will be cheaper and simpler to replace if necessary than an elbow in the piping.

When pressures higher than those indicated in Fig. 4 are encountered, or when it is desired to reduce the noise incidental to the breaking down of the discharge pressure through a single orifice, special multiple pressure reducing orifices can be installed. These are readily available on the market.

Bypass Control

The arrangement illustrated in Fig. 3 is based on a manual control of the bypass. Two valves are used, one on each side of the orifice. One of these remains locked in the open position and is only closed to isolate the orifice for inspection or replacement. The second is the control valve and remains either open or closed. The control of this valve is frequently made automatic and responsive to the metering of the flow through the pump. But for small installations, automatic control would be unjustifiably expensive. If it is preferred to have an absolute assurance that the pump will never operate against complete shut-off, it is possible to lock the control valve in the open position.

But whatever the service on which a centrifugal pump is installed, make provision that it cannot operate against complete shut-off for a long enough period to cause a dangerous rise in temperature.

Priming

With some very few exceptions, no centrifugal pump should ever be started until it is fully primed, that is until it has been filled with the liquid pumped and all the air contained in the pump has been allowed to escape. The exceptions involve self-priming pumps and some special large capacity, low head and low speed installations where it is not practical to prime the pump prior to starting, and the priming takes place almost simultaneously with the starting.

It is not possible to present a complete treatise on the various methods and arrangements used for priming centrifugal pumps. The following will, therefore, be a general outline of the most commonly encountered methods. A centrifugal pump can be primed by one of the following methods, depending on operating conditions:

A.—When the pump operates with a positive suction head:

1. Open all suction valves to allow the liquid to enter the suction piping and the pump casing.
2. Open all the vent valves located on the casing high points in order to release all entrapped air.
3. When the liquid flows out of the vents in a steady stream without any air bubbles, the pump is primed and may be started.

B—When the pump operates with a negative suction head:

In this case, the pump can be primed by means of an ejector, an exhauster or a vacuum pump. Since all three procedures are similar, we shall describe the recommended method using an ejector.

1. Attach an ejector to the highest point provided for venting the casing, as in Fig. 6.
2. Close the discharge valve and open the suction valve.
3. Start the ejector (actuated by steam, high pressure water or compressed air). This will exhaust the air from the pump and from the suction line.
4. When the ejector waste pipe throws a continuous stream of water, the pump is primed and may be started.
5. In order to assure that the pump will not lose its prime, the ejector should be allowed to operate until the pump is up to operating speed. A continuous

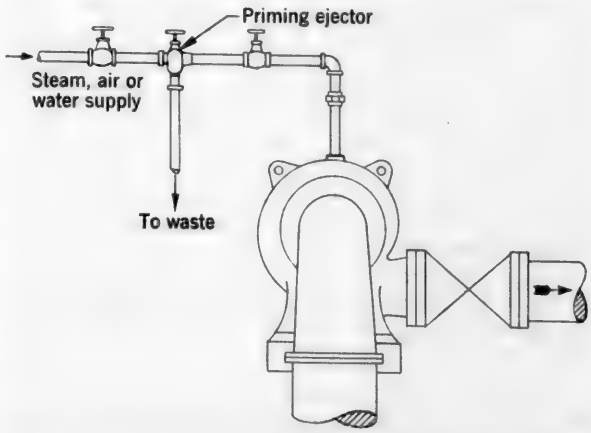


Fig. 6. Arrangement for priming a centrifugal pump with an ejector.

stream of water will indicate that the prime is held.

C—Alternate method when the pump operates with a negative suction head. (Maintaining the prime with a foot valve).

A foot valve should be used at the lowest point on the suction line as in Fig. 7. It will retain liquid in the suction pipe and in the pump casing after the pump has been initially primed. This initial priming may be accomplished as follows:

1. Fill the suction piping and the casing with liquid from an independent source of supply.
2. Open petcocks at all high point vents on the casing to allow air to escape.
3. When liquid appears as a steady stream out of the petcocks, the pump is primed and may be started.

Foot valves are not recommended when solids are present in the liquid pumped, since the solids could lodge between the foot valve moving parts and the seat. They may also be objectionable in some installations because of their high friction losses.

Part 2 of this article will discuss the general precautions which must be observed before the initial starting and the recommended starting and stopping procedures. It will also discuss certain general rules to follow on pump operation.

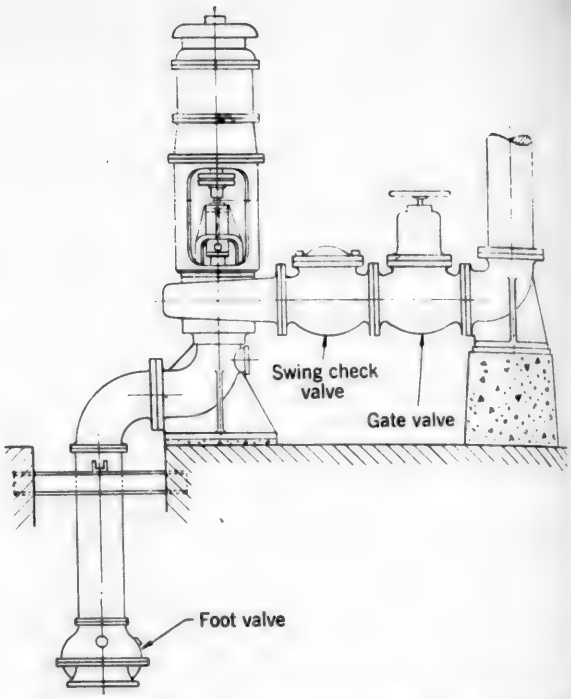


Fig. 7. Typical foot valve installation with a centrifugal pump to retain initial prime.

Automatic Packaged Coal-fired Steam Generator

A new concept in the design of a small coal burning steam plant was developed as the result of research instituted by Bituminous Coal Research, Inc.

The first completely successful automatic packaged coal-fired steam generator was put into operation at the Columbus laboratory of Bituminous Coal Research, Inc., on December 12, 1956. Three and a half years of research, design and testing of water-cooled and air-cooled stockers adapted to firetube- and watertube-type boilers preceded this startup. The successful model includes a compact 5-pass firebox-type watertube boiler and a water-cooled pulsating grate stoker which continually discharges ash to an automatic ash removal conveyor. Complete automation of these components is accomplished by a simple and rugged mechanical-electrical control system which is provided with all safety limits. The design can be built for pressures to 200 psig for steam or hot water, in capacities to 15,000 lb of steam or 15 million Btu per hr before shipping clearance limitations preclude factory assembling.

The fundamental requirements for the development of a coal-fired automatic packaged steam generator were set down at the beginning of the project. These included the following:

1. Provide a boiler-burner combination which could burn a variety of bituminous coals efficiently and could accommodate a varying load. The burner must have a quick heat-release response to sudden load increases and give economical operation over a five-to-one turndown ratio.

2. Design an automatic ash-removal mechanism to be an integral part of the boiler-burner combination, to provide for accumulating the refuse discharged by the grate. This mechanism must automatically convey the refuse to a storage bin, containers or to some other conveyor.

3. Develop a control system that would automatically co-ordinate the functions of the forced-draft and induced-draft fans, stoker, ash conveyor and all safety limits so that the steam generator would efficiently carry wide and sudden load changes. Also the control system, in response to an external signal, must be capable of cutting the generator out of service, maintain a non-steaming banked fire for indefinite periods of time, and again in response to a signal bring the generator up to operating conditions. All of these functions must be without manual attention.

4. The complete generator must have maximum compactness. The design of all of the components, boiler, burner, fans, ash conveyor, and controls, must permit factory assembling and testing of the assembled combination before the package is shipped to the user.

5. The complete generator must include such equipment as would assure an economically-feasible product. The selling price must be competitive with the package steam generators using other fuels.

(Window series continued from June, 1958 Data Sheet)

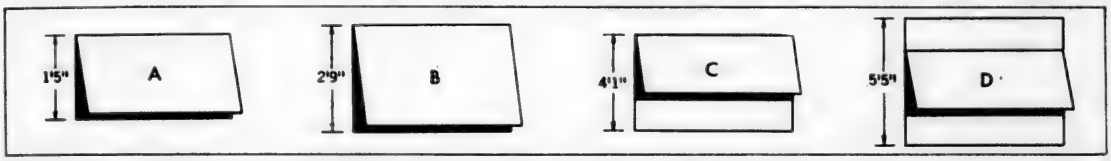
HEAT LOSS THROUGH STEEL WINDOWS

The accompanying tabulations cover heat loss by transmission and infiltration through various types of steel windows on the 0 to 70 deg. temperature difference basis. The same principles apply as to wood windows as explained under "Heat Loss through Wood Windows."

For steel windows, the value of q (cubic feet per hour leakage per foot of crack) varies with the particular type of window. Values of q (based on a 15 mph wind velocity) used were:

Double-hung steel windows, weatherstripped 32
Double-hung steel windows, not weatherstripped 72
Steel casement windows, 1/64 in. crack 33
Steel casement windows, 1/32 in. crack 52
Industrial pivoted steel windows, 1/16 in. crack .. 176
Industrial pivoted steel windows, 1/32 in. crack . 88
Commercial projected steel windows, 1/16 in. crack 176
Commercial projected steel windows, 1/32 in. crack 88
Architectural projected steel windows, 1/64 in. crack 62
Architectural projected steel windows, 1/32 in. crack 88
Combination side-hinged and projected steel windows, 1/64 in. crack 18
Combination side-hinged and projected steel windows, 1/32 in. crack 38

HEAT LOSSES (0° TO 70°), ARCHITECTURAL PROJECTED STEEL WINDOWS



Symbol (See Drawing Above)	Opening, Ft. and In.		Area, Sq. Ft.	Heat Loss through Glass, Btu per Hr.	Crack, Ft.	Infiltration Loss, Btu per Hr.		Total Window Loss, Btu per Hr.	
	Width	Height				1/64 In. Crack	1/32 In. Crack	1/64 In. Crack	1/32 In. Crack
A	2'07/8"	1'5"	2.94	233	7.02	548	779	781	1012
	2'87/8"		3.89	308	8.32	649	924	957	1232
	3'47/8"		4.84	383	9.66	753	1072	1136	1455
	3'87/8"		5.31	420	10.32	805	1146	1225	1566
	4'07/8"		5.78	457	10.98	856	1219	1313	1676
	4'87/8"		6.73	532	12.32	961	1368	1493	1900
B	2'07/8"	2'9"	5.69	450	9.66	753	1072	1203	1522
	2'87/8"		7.54	596	10.98	856	1219	1452	1815
	3'47/8"		9.38	742	12.32	961	1368	1703	2110
	3'87/8"		10.29	814	12.98	1012	1441	1826	2255
	4'07/8"		11.19	885	13.64	1064	1514	1949	2399
	4'87/8"		13.04	1031	14.98	1168	1663	2199	2694
C	2'07/8"	4'1"	8.45	668	9.66	753	1072	1421	1740
	2'87/8"		11.18	884	10.98	856	1219	1740	2103
	3'47/8"		13.91	1100	12.32	961	1368	2061	2468
	3'87/8"		15.26	1207	12.98	1012	1441	2219	2648
	4'07/8"		16.61	1314	13.64	1064	1514	2378	2828
	4'87/8"		19.34	1530	14.98	1168	1663	2698	3193
D	2'07/8"	5'5"	11.22	888	9.66	753	1072	1641	1960
	2'87/8"		14.85	1175	10.98	856	1219	2031	2394
	3'47/8"		18.48	1462	12.32	961	1368	2423	2830
	3'87/8"		20.27	1603	12.98	1012	1441	2615	3044
	4'07/8"		22.06	1745	13.64	1064	1514	2809	3259
	4'87/8"		25.69	2032	14.98	1168	1663	3200	3695

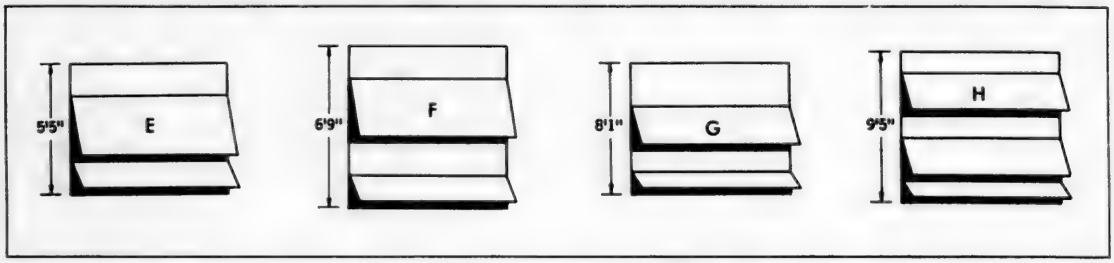
The drawings shown in certain tables are not to scale and for many cases not in proportion; their purpose is to show general arrangement. The direction of projection (in or out) is, in the drawings, all one way, since this is of no significance to the heating engineer.

The values of q as given are not necessarily the values which might apply to a given installation, since the quality of workmanship both in manufacture and installation can affect this value considerably. It should also be noted that the infiltration loss applies only to the crack opening around movable sections of the window and does not include any infiltration around the overall window frame; in other words, the table assumes perfect caulking around the frame.

For design temperature differences other than 0 to 70 deg., multiply the Btu values in the tables by the correction factors as given under "Heat Loss through Wood Windows."

In all cases, the window opening has been calculated as all glass, with a U value of 1.13.

HEAT LOSSES, ARCHITECTURAL PROJECTED STEEL WINDOWS (Ctd.)



Symbol (See Drawing Above)	Opening, Ft. and In.		Area, Sq. Ft.	Heat Loss through Glass, Btu per Hr.	Crack, Ft.	Infiltration Loss, Btu per Hr.		Total Window Loss, Btu per Hr.	
	Width	Height				1/64 In. Crack	1/32 In. Crack	1/64 In. Crack	1/32 In. Crack
E	2'0 7/8"	5'5"	11.22	888	14.34	1119	1592	2007	2480
	2'8 7/8"		14.85	1175	16.35	1275	1815	2450	2990
	3'4 7/8"		18.48	1462	18.36	1432	2038	2894	3500
	3'8 7/8"		20.27	1603	19.35	1509	2148	3112	3751
	4'0 7/8"		22.06	1745	20.34	1587	2258	3322	4004
	4'8 7/8"		25.69	2032	22.35	1743	2481	3775	4513
F	2'0 7/8"	6'9"	13.97	1105	16.35	1275	1815	2380	2920
	2'8 7/8"		18.50	1463	19.35	1509	2148	2972	3611
	3'4 7/8"		23.02	1821	21.74	1696	2413	3517	4234
	3'8 7/8"		25.25	1997	23.06	1799	2560	3796	4557
	4'0 7/8"		27.47	2173	24.38	1902	2706	4075	4879
	4'8 7/8"		32.00	2531	27.06	2111	3004	4642	5535
G	2'0 7/8"	8'1"	16.73	1323	16.35	1275	1815	2598	3138
	2'8 7/8"		22.14	1751	19.35	1509	2148	3260	3899
	3'4 7/8"		27.55	2179	21.74	1696	2413	3875	4592
	3'8 7/8"		30.22	2390	23.06	1799	2560	3189	4950
	4'0 7/8"		32.89	2602	24.38	1902	2706	4504	5308
	4'8 7/8"		38.30	3030	27.06	2111	3004	5141	6034
H	2'0 7/8"	9'5"	19.50	1542	23.66	1845	2626	3387	4168
	2'8 7/8"		25.81	2042	27.06	2111	3004	4153	5046
	3'4 7/8"		32.12	2541	30.36	2368	3370	4909	5911
	3'8 7/8"		35.23	2787	32.01	2497	3553	5284	6340
	4'0 7/8"		38.34	3033	33.66	2625	3736	5658	6769
	4'8 7/8"		44.65	3532	37.01	2887	4108	6419	7640

(Continued on future Data Sheets)

Ventilating Dairy Cattle Shelters

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Special ventilation problems are provided by dairy cattle in shelters because of large amounts of humidity and heat produced by these animals. Information is presented on how these shelters should be ventilated and the temperature conditions found best for milk production and animal health. Data are included on fan selection and sizes.

FOUR principal objectives are sought when ventilating dairy cattle shelters, as follows:

1. An optimum humidity.
2. An optimum temperature.
3. Odor removal.
4. Fresh breathing air.

Effect of Humidity and Temperature

Dairy cattle dissipate a rather large amount of water and without ventilation their stables become very humid. Such excessive stable humidity is detrimental from the standpoint of structural damage, spoilage of feed, and animal health. Without proper ventilation, wooden components of the structure rot, steel members rust, paint fails, and the life of the structure is greatly shortened. Feed, particularly when stored within the structure, spoils easily in a humid environment. The effects of high humidity on the health of cattle is not definitely established. However, high humidity is generally associated with a higher incidence of pneumonia among cattle. On the other hand, dust becomes a problem when the humidity is too low. The dust from the bedding and hay is not only disagreeable to the worker but dust is an excellent carrier of bacteria and contributes to respiratory infections. Generally a range of 55 to 75% relative humidity is considered optimum.

Barn temperatures should be controlled within a range that will provide maximum production and operator comfort. Actually, milk production remains high over a wide range of temperatures (20 to 75 deg F). At the colder temperature, only slightly more roughage is required for each pound of milk produced. It is generally desirable to maintain dairy shelter temperatures above 32 deg in order to prevent the freezing of the barn water system. Worker comfort is difficult to evaluate. Insofar as most present day ventilation systems are designed for cold weather operation, the operator would be subjected to less temperature change upon leaving the barn with low barn temperatures. As ventilation design loads are considered, it will be noted that stable moisture dissipation rates drop with lower temperatures while the available animal heat for warming incoming air increases. Optimum design temperatures, therefore, fall between 35 and 50 deg.

Odors present a problem insofar as they may contaminate the milk. One of the strongest odors is that of ammonia from feces and urine. Of course workers find strong ammonia odors objectionable but there is no evidence that ammonia presents a health hazard in the concentrations of ammonia odors that are normally found in dairy barns.

Fresh Air

Fresh air for breathing was one of the early considerations in barn ventilation. At 50 deg. the breathing air is changed from .03% when inhaled, to about 3% carbon dioxide when exhaled. Roughly about 5 cu ft per hr of carbon dioxide are given off by a 1000-pound lactating cow at a temperature of 50 deg. Carbon dioxide production increases slightly with colder temperatures and decreases with higher temperatures. Experience has shown that the levels of carbon dioxide seldom, if ever, build up to the point that they create a health hazard in dairy stables.

Generally, the removal of stable moisture receives the major consideration in the design of dairy shelter ventilation systems. When this objective is satisfied, the other objectives are automatically met. With most ventilation systems, the body heat of the cows is sufficient to warm the building and the incoming air. Only in very cold climates and with poorly insulated walls or with an insufficient number of cattle for the space ventilated, is supplemental heat desirable. In general there should be the equivalent of a 1000-pound cow for every 550 to 650 cu ft of space.

The opening and closing of windows is the least desirable for ventilating dairy barns. Weather conditions change too rapidly, and should the windows be opened too far, objectionable drafts might occur which may very well set back milk production. Window systems also require a great deal of labor and attention. Added to this are the difficulties of adjusting the windows, particularly when they are constructed of wood and swelled during moist conditions within the stable.

Gravity ventilation systems using metal or wooden outlet flues with uniformly spaced air inlets around the barn have often been recommended. However, the ducts are of relatively high cost, take up space, and are not adapted to automatic control.

Fans and Blowers

Mechanical ventilation is the most popular. It has the advantage of positive air movement control, of being readily adapted to automatic control, of being better adapted to one-story barn construction, and being of reasonable cost. Mechanical ventilation may be accomplished by using exhaust fans or intake fans or combinations of the two. The exhaust fan has the widest use.

The selection of ventilating fans or blowers depends on the moisture loads expected, the heat available, the climate, the structural heat losses, and the noise level. Noise

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level need be considered only from the standpoint of worker comfort.

Expected Moisture Loads

Figure 1 shows the moisture loads that might be expected in a dairy stable and the heat that will be available for maintaining barn temperatures. Data were obtained from studies of mature Jersey and Holstein cows and were taken from Missouri Agricultural Experiment Station Research Bulletin 542 by H. J. Thompson, March, 1954. The data are presented in units of 1000-pounds of animal body weight. It is sufficient to estimate the gross weight of all cattle in the barn to determine the number of 1000-pound animal units. The data are for stanchioned mature cattle but if the number of small calves in the stable is relatively small, their body weights may be included in the gross weight value. Generally, cattle that are in pens create greater moisture loads per unit body weight than those in stalls.

Knowing the overall heat transfer coefficient of the structure and the number of animal units within the structure, the required air flow may be calculated for various weather conditions. The housing period will vary with the management practices followed but design considerations should include both extremely cold weather (January) and the more mild spring conditions (April).

Fan Selection and Size

Fans should be selected according to their capacity at 1/8 inch static pressure, minimum.

General rules of thumb for fan capacity vary from 59 cfm per 1000-pound animal unit in extremely cold weather to over 200 cfm per 1000-pound animal unit in warmer climates.

The choice of exhaust or intake fans are generally determined by their relative costs. If practical, the exhaust fan should be on the lee side of the barn to reduce the static pressure. Location of the fan in any wall near the ceiling may be satisfactory if the barn is of tight construction. However, with sliding doors or other loose fitting doors, it is generally desirable to place the exhaust fans reasonably far from such doors to prevent "short circuiting" of the air. Common practice is to locate exhaust fans midway along the long dimension of the smaller barns or equally spaced along such walls if more than one fan are required. Sometimes the placement of an exhaust fan at the cold end of the barn is recommended to draw warm air to the colder area. However, loose fitting doors often cause one end to be cold and an exhaust fan located there would accentuate the problem rather than correct it.

Intake fans should be equipped with diffusers to prevent drafts and to provide rapid mixing of warm stable air with cold outside air. The successful intake fans systems that have been observed by the author used several small fans evenly spaced along both of the side walls of the dairy barn.

Air inlets (or outlets for intake fan systems) are required in tightly constructed structures. Such inlets should be located along walls that are opposite the fans so that air circulates across the barn. However, many older barns have sufficient crack space around windows and doors so that other inlets need not be provided.

Control Systems

Control systems are varied. Either thermostats and humidistats may be used successfully and their location is also varied. Some two-speed exhaust fans, where the fans operate continuously at low speed, may be successfully operated for high speed operation with the thermostat located in the air stream at the fan.

For other systems the thermostat (or humidistat) is generally placed near the ceiling at sufficient height to be safe from damage by cattle or equipment. Near-center of barn locations are favored. However, any ceiling location that is free from drafts of incoming air would be satisfactory. Hay chutes, doors, or windows may be sources of such drafts.

With loose housing systems for housing dairy cattle, which is being adopted by an increasing number of farmers, there is no need for artificial ventilation. However, it will be many years before stall type barns are out of existence, and in the meantime, ventilation will be required.

Summer ventilation of dairy shelters has received very little attention since most management practices call for the cattle to be in the barn only at milking time. Considerable interest is being shown in summer management practices that involve bringing the feed to the cow.

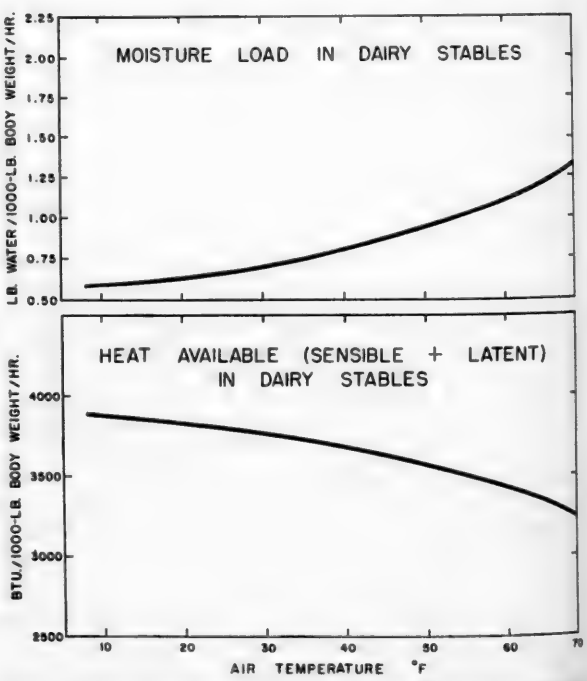
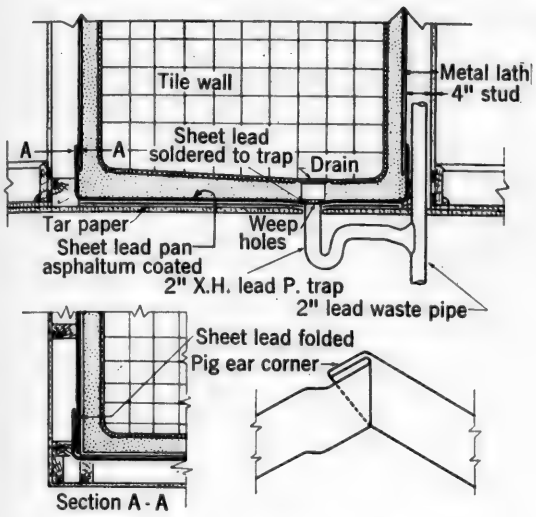
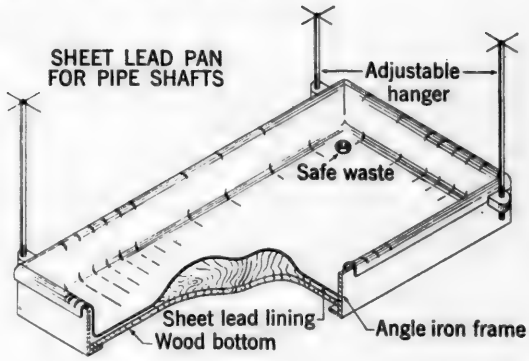


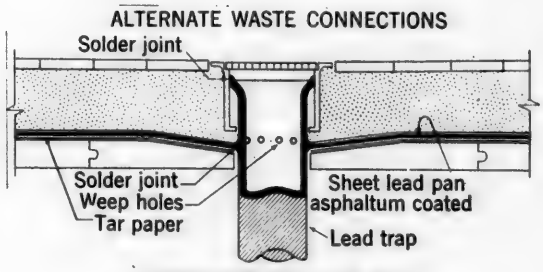
Fig. 1. Dairy stable moisture loads and the heat available to warm intake air at various stable air temperatures.

LEAD SHOWER AND SAFE PANS

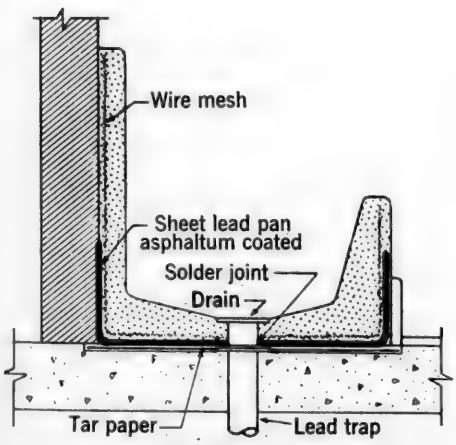


SHEET LEAD SHOWER PAN

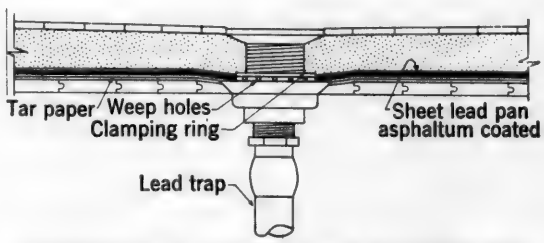




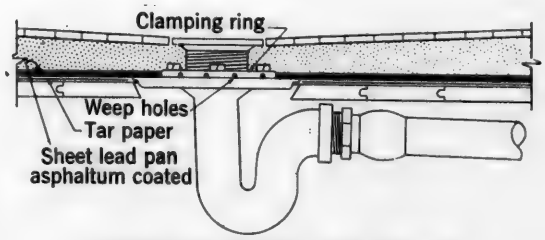
CONNECTION TO LEAD TRAP



SHEET LEAD PAN
JANITORS OR SLOP SINKS



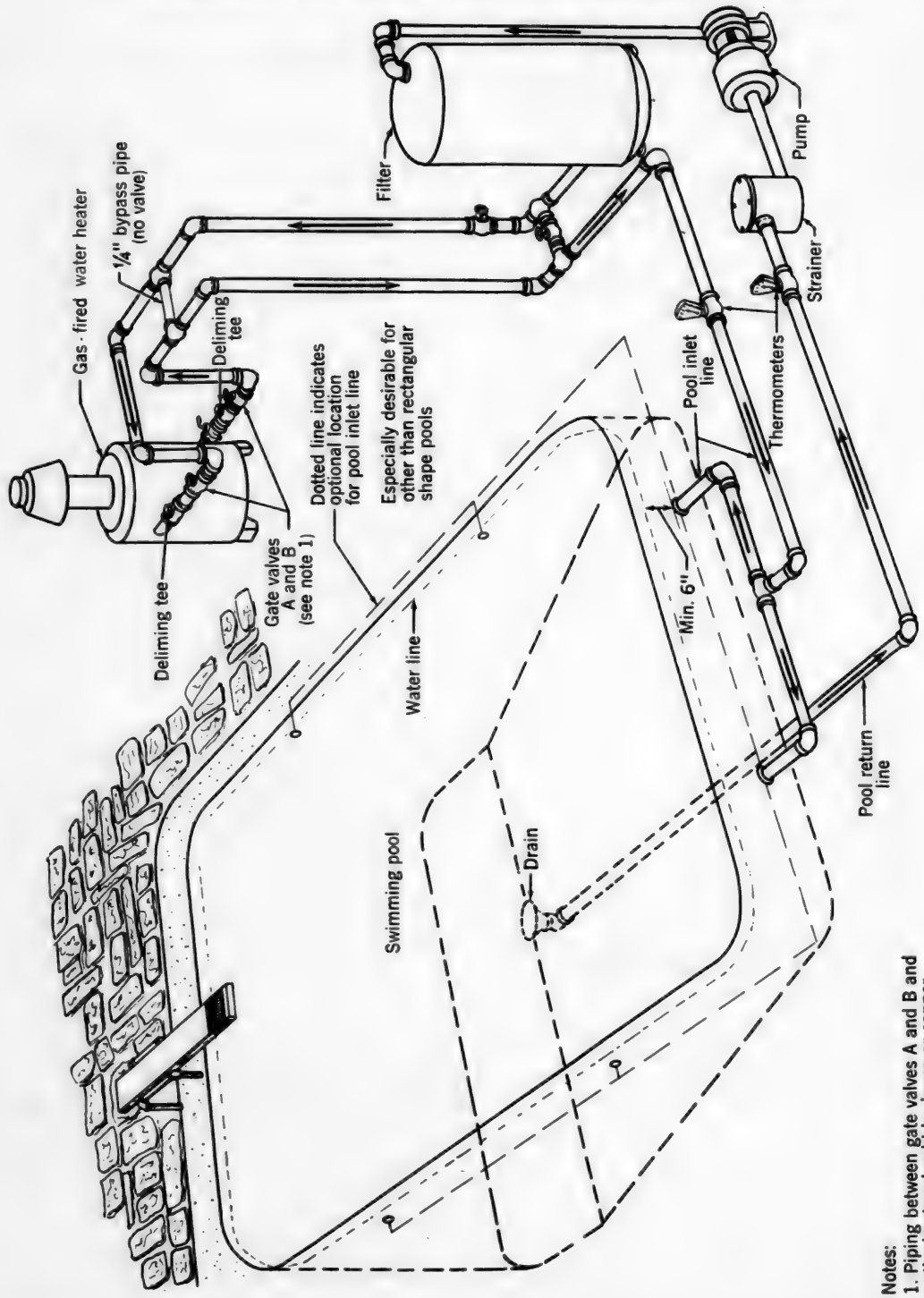
CONNECTION TO LEAD TRAP AND CLAMPING RING



CONNECTION TO CAST IRON DOUBLE DRAINAGE SHOWER TRAP

Drawings courtesy of Lead Industries Assn., New York, N. Y.

WATER PIPING FOR SWIMMING POOL



Drawing courtesy of A. O. Smith Corp., Permaglass Div., Kankakee, Ill.

Notes:
1. Piping between gate valves A and B and the heater should be brass or copper.
2. Multiple heater installation may be made when required.

AIR CONDITIONING, HEATING AND VENTILATING'S Reference Section

RAPID DESIGN OF HIGH VELOCITY DUCTS

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Here is a simple and flexible 14-step method for designing the high velocity ducting that serves the increasingly popular all-air high velocity heating and air-conditioning system. Included are basic data, direct-reading tables, and a work sheet. The method and the data incorporate the most recent research in the field of air moving. To illustrate the method, a single duct system for a 3-story office building is worked out. The 14 steps are shown on work sheet.

HIGH VELOCITY duct design is based on the same laws of fluid flow as used in the design of conventional duct systems. There are a few important differences, however:

Smaller ducts are used and, therefore, higher friction and dynamic losses are incurred. There is more extensive use made of standardized fittings. At high velocities, static pressure loss and static pressure regain, which are due to velocity changes, become significant. The following should be noted.

GENERAL CONSIDERATIONS

Selection of High Velocity Units— High velocity units and diffusers are selected from manufacturers' catalog ratings according to air flow rate (cfm), permissible sound level, and desired location.

Main Duct—The so-called critical duct run is chosen on the basis of the layout of the air distribution system, and not on the basis of length alone. That duct run with the higher air flow rate, with more fittings, and/or with a high velocity terminal having greater minimum resistance, is often more appropriate as a basis for duct design.

Duct Velocity and Friction— An initial main duct velocity of approximately 4000 to 4500 fpm and a constant friction loss of about 1.0 inch of water per 100 ft of run are recommended.

Dynamic Losses— Static pressure drop, caused by branch take-offs, elbows, and duct fittings, depends upon both fitting design details and air velocity. Tables 2-A to 5 permit direct reading of pressure drop due to commonly used fittings.

Static Pressure Loss and Regain— Velocity drop in a system can produce regain of static pressure, and, conversely, a velocity rise will result in a loss of static pressure. These changes occur in connection with conversion of velocity into static pressure and vice versa. They are important because they may result in reduction of required fan horsepower. Their calculation is also essential in determining available and regained static pressures for branch duct design.

Table 1 permits direct reading of static regain, or transition loss, by relating downstream velocity to upstream velocity. The values in the table apply equally to reducer transitions with included angle between 45° and 60°. Caution: the values do not apply to velocity

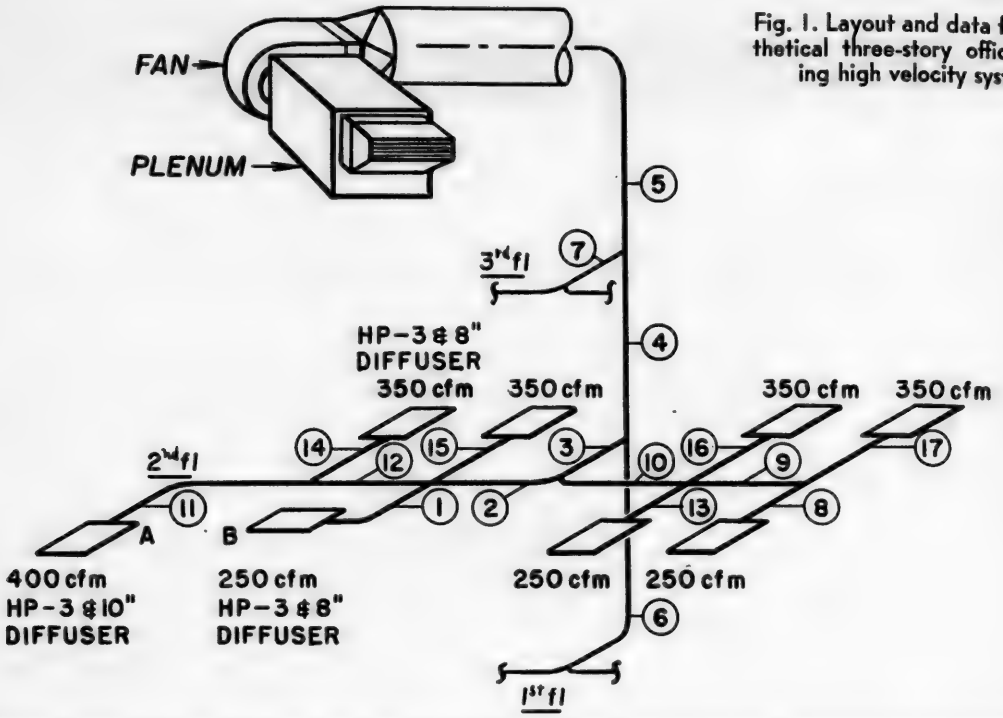


Fig. 1. Layout and data for hypothetical three-story office building high velocity system.

HIGH VELOCITY TERMINALS					
CFM	UNIT	INLET DIA	DIFFUSER DIA	MIN. S.P.,"W.G.	MIN. db RATING
250	HP-2	4"	8"	.3	33
350	HP-3	5"	8"	.2	40
400	HP-3	5"	10"	.23	37

DUCTING					
SECTION	CFM	LENGTH, FT	SECTION	CFM	LENGTH, FT
(1)	250	9	(8)	250	6
(2)	1350	10	(9)	600	10
(3)	2550	6	(10)	1200	10
(4)	5100	12	(11)	400	12
(5)	7650	16	(12)	750	10
(6)	2550	18	(13)	250	6
(7)	2550	6	(14)-(17)	350	6

☒ MAIN DUCT ☒ BRANCH TRUNK DUCT ☐ SINGLE BRANCH LINE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DUCT SECTION OR FITTING DETAIL	CFM	FPM	DIA. IN.	SECT. LGTH. FT.	SP 100 FT. "WG	$\frac{V_s}{V_u}$	STATIC PRESSURE, "WG					BRANCH-OFF		REMARKS
							PRELIM.	VEL. CONVERS'N LOSS	VEL. CONVERS'N REGAIN	SECT'L.	CUMUL.	AT	AVAIL. SP	
HP-2&8"Diff.	250						.3							
1	250	2800	4	9	3.5		.315	-*		1.157	1.157			Mfr's Ratgs
90°L,R=1.5D, 5 Pc.	5 Pc.	2800	4				.117							Table III
90°T Short Cone	250	2800				1.12	.425							Table II-A
2	1350	2500	10	10	.9		.09		-*					
45°L,R=1.5D, 3Pc.*		2500	10				.047			.176	1.333			
45° T	1350	2500				.80	.039							Table II-B
3	2550	3200	12	6	1.2		.072		-*	.312	1.645			
90°T, Long Cone	2550	3200				.86	.24							
4	5100	3700	16	12	1.1		.132		.28	-.148	1.497			
5	7650	4400	18	16	1.3		.208	-	-	.498	1.995			
90°L,R=1.5D, 5Pc.*		4400	18				.29							
Draw-Thru Fan System, 30° Incl. Angle Transition, V_1=5000 fpm; V_2=4400 fpm									.154)	.496	2.491			Table Mfr's Ratgs & Sep.Calc.
Primary Equipment & Air Intake							.65							
	Static Pressure Recheck of Other Branch Trunk Ducts:													
1st Floor	Equal to Main Duct Sections 1,2									1.333		3	1.645	(Longest duct run)
6	2550	3200	12	18	1.2		.216		.171	.198	1.531			OK
90°L,R=1.5D, 5Pc.*		3200	12				.153							
3rd Floor	Equal to Main Duct Sections 1,2									1.333		4	1.497	(Lowest available S.P. at take-off)
7	2550	3200	12	6	1.2		.072		-*	.072	1.405			
90°T, Long Cone	2550	3200				.725	-							OK
	Select fan on basis of 2.491, say 2.5" w.g. overall S.P. resistance.													
HP-2&8"Diff.	250						.3					2	1.333	
8	250	2800	4	6	3.5		.21	-*		.95	.95			
(90°)T (Short Cone)	250	2800				1.27	(.44)							
9	600	2200	7	10	1.2		.12		.124	-.004	.946			
10	1200	2700	9	10	1.2		.12		-*					
(45°)L,R=1.5D, 3Pc.*		2700	9				(.055)			.26	1.206			OK
(45°) T	1200	2700				.845	(.085)							
Preliminary S.P.=							.75	—	.124 = .626;					
Available for fittings: 1.333 - .626 = .707, Selected: Section 8 - 90°T, Short Cone = .44														
									* 10 - 45°L,R=1.5D, 3 Pc. = .055					.58" w.g.
									45° T = .085					
Excess available S.P. absorbed at terminal inlet valve: .707 - .58 = 1.333-1.206 = .127" w.g.														
HP-3&10"Diff.	400						.23					1	1.157	
11	400	3000	5	12	3.0		.36	.29		1.015	1.015			
90°L(R=1.5D)	400	3000					(.135)							
12	750	2200	8	10	.9		.09		.068	.022	1.037			OK
13	250	Equal to Section 8				1.04	.51+.41	-*		.92		9	.946	OK
HP-3&8"Diff.	350						.2							
14	350	2600	5	6	2.25		.135	-*		.705		11	1.015	**)
90°T, Short Cone	350	2600				1.18	.37							
15	350	Equal to Section 14				1.04	.335+.36	-*		.695		1	1.157	**)
16	350					.965	.335+.34		-*	.675		9	.946	
17	350					1.18	.335+.37	-*		.705		8	.95	

Notes:

-* Table I values do not apply, when change in velocity is combined with change in direction of flow (elbow or branch take-off)

** 90° cyl. branch take-off fittings could be used for sections 14 and 15, but short cone type was selected throughout for reasons of uniformity and safety.

Fig. 2. Work sheet for building of Fig. 1.

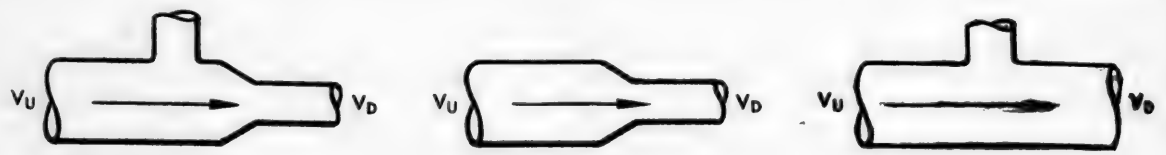
changes that occur with a change in direction of the airstream, as at an elbow or a branch take-off.

Primary Equipment Losses— To determine the overall static pressure drop for fan selection, it is essential to consider also the losses due to primary equipment, such as coils and filters; losses due to fresh-air intakes, return ducts (unless a separate return air fan is provided) and transitions between fan, plenum, and heat-exchange apparatus (see Table 6).

Branch Trunk Ducts — Generally, branch ducts are sized on the basis of an equal friction loss of 1.0 inch per 100 ft of run. Take-offs and other fittings are selected according to the difference of static pressure available at take-off, less branch friction and terminal pressure resistance. Thus, excess available pressure may be partly absorbed by choosing fittings with higher resistance. The first branch take-off, and frequently the last branch take-off, are to be considered fittings of the branch trunk duct for sizing purposes.

TABLE I—STATIC REGAIN AND TRANSITION LOSS, INCHES WG.

(Values below and to the left of the heavy stepped line are static regain; above and to the right they are transition loss.)



Upstream Velocity	Downstream Velocity V_D, fpm																			
V_U,fpm	600	800	1000	1200	1400	1600	1800	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200
600	.001	.02	.043																	
800	.015	.002	.026	.055	.088															
1000	.035	.018	.003	.032	.066	.106														
1200	.06	.043	.022	.005	.038	.078	.122	.172	.20											
1400	.09	.072	.051	.026	.006	.046	.09	.14	.167	.195	.22	.26	.29							
1600	.123	.116	.084	.058	.03	.008	.05	.102	.129	.16	.185	.22	.25	.28	.32					
1800	.161	.144	.123	.096	.066	.033	.01	.06	.087	.115	.143	.175	.21	.24	.27	.30	.35			
2000	.20	.186	.165	.139	.106	.073	.036	.013	.04	.068	.096	.128	.16	.194	.23	.26	.30	.34	.38	.42
2100	.23	.21	.188	.162	.132	.096	.058	.016	.014	.042	.070	.102	.134	.168	.20	.24	.28	.31	.35	.40
2200	.25	.23	.21	.186	.156	.12	.081	.04	.016	.015	.043	.075	.107	.141	.17	.21	.25	.29	.33	.37
2300	.27	.25	.23	.21	.18	.144	.104	.062	.043	.016	.016	.048	.08	.114	.148	.183	.22	.26	.30	.34
2400	.30	.28	.26	.24	.21	.172	.131	.089	.065	.045	.017	.018	.05	.084	.118	.153	.191	.23	.27	.31
2500	.33	.31	.29	.26	.23	.198	.158	.114	.093	.068	.047	.017	.02	.054	.088	.123	.161	.20	.24	.28
2600	.36	.34	.32	.29	.26	.23	.188	.143	.119	.097	.071	.049	.017	.021	.055	.09	.128	.168	.21	.25
2700	.39	.37	.35	.32	.29	.26	.22	.172	.147	.124	.10	.074	.051	.018	.023	.058	.096	.135	.175	.22
2800	.42	.40	.38	.35	.32	.29	.25	.21	.178	.152	.129	.103	.077	.052	.018	.025	.062	.102	.141	.183
2900	.45	.43	.41	.39	.36	.32	.28	.24	.21	.185	.158	.134	.107	.080	.054	.019	.026	.065	.105	.147
3000	.48	.47	.45	.42	.39	.35	.31	.27	.24	.22	.192	.164	.139	.11	083	.056	.019	.028	.068	.11
3100	.52	.50	.48	.45	.42	.39	.35	.30	.28	.25	.23	.198	.17	.144	.114	.087	.057	.02	.03	.072
3200	.55	.54	.52	.49	.46	.42	.38	.34	.31	.29	.26	.23	.21	.176	.149	.118	.09	.059	.02	.032
3300	.58	.57	.55	.53	.50	.46	.42	.37	.35	.32	.30	.27	.24	.21	.183	.153	.122	.093	.06	.021
3400	.63	.61	.59	.56	.53	.50	.46	.41	.39	.36	.34	.31	.28	.25	.22	.189	.158	.126	.096	.061
3500	.67	.65	.63	.60	.57	.54	.50	.45	.43	.40	.38	.35	.32	.29	.26	.22	.194	.162	.129	.099
3600	.71	.69	.67	.64	.61	.58	.54	.49	.47	.44	.42	.39	.36	.33	.30	.26	.23	.199	.166	.132
3700	.75	.73	.71	.68	.65	.62	.58	.53	.51	.48	.46	.43	.40	.37	.34	.31	.27	.24	.20	.171
3800	.79	.77	.75	.72	.69	.66	.62	.58	.55	.52	.50	.47	.44	.41	.38	.35	.31	.28	.25	.21
3900	.83	.81	.79	.76	.73	.70	.66	.62	.59	.57	.54	.51	.48	.45	.42	.39	.36	.32	.29	.25
4000	.88	.86	.84	.81	.78	.74	.70	.66	.64	.61	.58	.55	.52	.49	.46	.43	.40	.36	.33	.29
4100	.92	.91	.88	.86	.83	.79	.75	.71	.68	.66	.63	.60	.57	.54	.51	.48	.45	.41	.37	.34
4200	.97	.95	.93	.90	.87	.84	.80	.76	.73	.70	.68	.65	.62	.59	.56	.53	.49	.46	.42	.38
4300	1.02	1.0	.98	.95	.92	.88	.84	.81	.78	.75	.73	.70	.67	.64	.61	.57	.54	.50	.47	.43
4400	1.07	1.05	1.03	1.00	.97	.93	.89	.85	.83	.80	.78	.75	.72	.69	.66	.62	.59	.55	.52	.48
4600	1.17	1.15	1.13	1.10	1.07	1.04	1.00	.95	.93	.90	.88	.85	.82	.79	.76	.72	.69	.65	.62	.58
4800	1.27	1.25	1.23	1.20	1.17	1.14	1.10	1.05	1.03	1.00	.98	.95	.92	.89	.86	.83	.79	.75	.72	.68
5000	1.38	1.37	1.34	1.32	1.28	1.25	1.21	1.17	1.14	1.11	1.09	1.06	1.03	1.00	.97	.94	.90	.87	.83	.79
5200	1.50	1.48	1.46	1.43	1.40	1.36	1.33	1.28	1.26	1.23	1.20	1.18	1.15	1.12	1.09	1.05	1.02	.98	.95	.91
5400	1.61	1.60	1.58	1.55	1.52	1.48	1.44	1.40	1.37	1.35	1.32	1.29	1.27	1.24	1.20	1.17	1.14	1.10	1.07	1.03
5600	1.73	1.72	1.70	1.67	1.64	1.61	1.57	1.53	1.50	1.47	1.45	1.42	1.39	1.36	1.33	1.30	1.26	1.23	1.19	1.15
5800	1.86	1.85	1.83	1.80	1.77	1.74	1.70	1.66	1.63	1.60	1.57	1.55	1.52	1.49	1.46	1.43	1.39	1.36	1.31	1.28
6000	1.99	1.98	1.96	1.93	1.91	1.87	1.83	1.78	1.76	1.73	1.71	1.68	1.65	1.62	1.59	1.56	1.52	1.49	1.45	1.41

TABLE I (CONTINUED)—STATIC REGAIN AND TRANSITION LOSS, INCHES WG.

Upstream Velocity V_U, fpm	Downstream Velocity V_D, fpm																			
	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4600	4800	5000	5200	5400	5600	5800	6000
600																				
800																				
1000																				
1200																				
1400																				
1600																				
1800																				
2000																				
2100	.44																			
2200	.41	.46																		
2300	.38	.43	.47																	
2400	.35	.40	.44	.49																
2500	.32	.37	.41	.46	.51															
2600	.29	.34	.38	.43	.47	.52														
2700	.26	.30	.35	.39	.44	.49	.54													
2800	.23	.27	.31	.36	.41	.46	.51	.56	.61	.67										
2900	.189	.23	.28	.32	.37	.42	.47	.52	.58	.63	.69									
3000	.152	.196	.24	.29	.34	.38	.44	.48	.54	.59	.65	.71								
3100	.114	.158	.20	.25	.30	.35	.40	.45	.50	.56	.61	.67	.79							
3200	.074	.118	.163	.21	.26	.31	.36	.41	.46	.52	.57	.63	.75	.87						
3300	.034	.078	.123	.169	.22	.27	.32	.37	.42	.48	.53	.59	.71	.83	.96					
3400	.021	.036	.081	.127	.176	.22	.28	.33	.38	.43	.49	.55	.67	.79	.91	1.05				
3500	.062	.022	.038	.084	.133	.182	.23	.28	.34	.39	.45	.50	.62	.74	.87	1.00				
3600	.102	.063	.022	.041	.087	.137	.188	.24	.29	.35	.40	.46	.58	.70	.83	.96	1.10			
3700	.136	.105	.064	.023	.043	.091	.143	.194	.25	.30	.36	.41	.53	.65	.78	.92	1.05			
3800	.175	.139	.108	.065	.023	.045	.094	.145	.20	.26	.31	.37	.49	.61	.74	.87	1.00			
3900	.22	.18	.142	.111	.066	.024	.048	.098	.153	.21	.26	.32	.44	.56	.69	.82	.96	1.10		
4000	.26	.22	.184	.146	.114	.067	.024	.05	.102	.16	.22	.27	.39	.51	.64	.78	.91	1.06		
4100	.30	.27	.23	.189	.149	.117	.068	.025	.053	.106	.162	.22	.34	.46	.59	.72	.86	1.00	1.15	
4200	.34	.31	.27	.24	.193	.153	.12	.068	.025	.055	.111	.167	.29	.41	.54	.66	.81	.95	1.10	
4300	.39	.35	.32	.28	.24	.198	.159	.123	.069	.026	.058	.114	.23	.35	.48	.62	.76	.90	1.05	
4400	.44	.40	.36	.33	.28	.25	.20	.164	.126	.07	.026	.061	.179	.30	.43	.56	.70	.84	.99	1.15
4600	.54	.50	.46	.42	.38	.34	.30	.25	.21	.174	.129	.071	.066	.188	.32	.45	.59	.73	.88	1.04
4800	.65	.60	.56	.52	.48	.44	.40	.36	.31	.27	.22	.18	.072	.072	.20	.33	.47	.62	.76	.92
5000	.76	.72	.68	.63	.59	.55	.50	.46	.41	.37	.32	.28	.186	.074	.078	.21	.35	.49	.64	.80
5200	.87	.83	.79	.75	.71	.66	.62	.57	.52	.48	.43	.39	.29	.192	.076	.084	.22	.37	.51	.67
5400	.99	.95	.91	.87	.82	.78	.73	.69	.64	.59	.54	.49	.40	.30	.20	.078	.091	.23	.38	.54
5600	1.11	1.08	1.03	.99	.95	.91	.86	.81	.76	.72	.66	.61	.52	.42	.31	.21	.079	.098	.25	.40
5800	1.24	1.20	1.16	1.12	1.08	1.03	.99	.94	.89	.85	.79	.74	.64	.54	.43	.32	.22	.08	.106	.26
6000	1.37	1.33	1.29	1.25	1.21	1.17	1.12	1.07	1.02	.98	.92	.87	.77	.66	.55	.44	.34	.22	.081	.115

Example 1: V_U = 4600 fpm, V_D = 4000 fpm; static regain = 0.25 inches wg. Example 2: V_U = 2200 fpm, V_D = 2600 fpm; transition loss = 0.141 inches wg.

Single Branch Lines— Generally, air flow rate (cfm) and terminal inlet size also determine branch duct velocity and diameter. Again, fitting details are selected according to available static pressure at the take-off.

Dual Duct Systems— Dual duct systems are designed in the same manner as single duct systems, with the following two exceptions:

First, the high velocity units are selected on the basis of sound level ratings corresponding to an inlet static pressure of 2.5 inches of water. However, the minimum inlet pressures of the selected units are used for the purpose of duct sizing and fan horsepower determination.

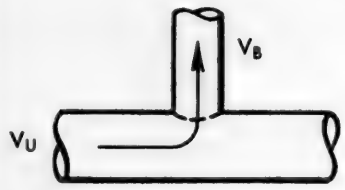
Secondly, to improve stability throughout the system, branch ducts and fittings are designed for low static pressure resistance and excess available static pressure is allowed to be absorbed at the inlet valves of the high velocity unit.

Design air quantities for cold ducts are usually 100% of the required cfm. Hot ducts are generally based on 50% to 75% of the cold duct cfm, depending upon the expected load variations, both external and internal, and the required comfort conditions.

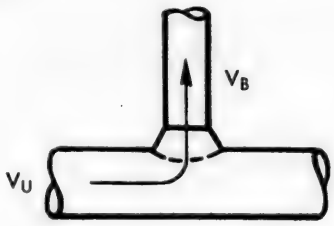
Combined Duct Systems— Sometimes high velocity ducting ends in a multiple (octopus) or end-discharge unit from which rectangular or round ducts carry air to the supply outlets at conventional velocities. Static pressure losses in these downstream portions of the system are determined in the same manner, with certain modifications noted later in this article.

Rectangular Ducts— Use of rectangular ducting in high velocity systems is generally avoided because of its greater weight per volume of air it carries, its greater cost, its lower rigidity, and because of leakage hazards.

TABLE 2-A—STATIC PRESSURE LOSSES IN 90-DEG BRANCH TAKE-OFFS, INCHES WG.



90° Cylindrical Branch Take-off



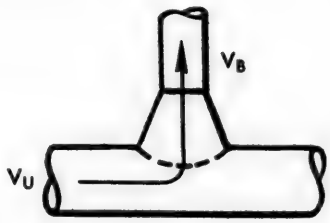
90° "Short Cone" Type Take-off

Branch Duct Vel., V_B fpm	90° Cylindrical	V_B/V_U = .6	.7	.8	.9	1.0	1.25	1.5
600	.034	.007	.013	.016	.017	.019	.02	.021
800	.06	.012	.023	.028	.03	.033	.036	.038
1000	.094	.019	.036	.043	.047	.052	.057	.059
1200	.135	.027	.052	.062	.068	.075	.082	.086
1400	.183	.037	.071	.084	.092	.101	.111	.116
1600	.24	.048	.093	.11	.12	.133	.146	.152
1800	.30	.061	.117	.139	.152	.168	.184	.192
2000	.37	.075	.144	.172	.182	.21	.23	.24
2100	.41	.083	.16	.19	.21	.23	.25	.26
2200	.45	.091	.175	.21	.23	.25	.28	.29
2300	.49	.099	.191	.23	.25	.27	.30	.31
2400	.54	.108	.21	.25	.27	.30	.33	.34
2500	.58	.117	.23	.27	.29	.32	.35	.37
2600	.63	.127	.25	.29	.32	.35	.38	.40
2700	.68	.136	.26	.31	.34	.38	.41	.43
2800	.73	.147	.28	.34	.37	.41	.44	.46
2900	.79	.157	.30	.36	.39	.44	.48	.50
3000	.84	.168	.32	.39	.42	.47	.51	.53
3100	.90	.18	.35	.41	.45	.50	.55	.57
3200	.96	.192	.37	.44	.48	.53	.58	.61
3300	1.02	.20	.39	.47	.51	.56	.62	.65
3400	1.08	.22	.42	.50	.54	.60	.66	.69
3500	1.15	.23	.44	.53	.57	.63	.70	.73
3600	1.21	.24	.47	.56	.61	.67	.74	.77
3700	1.28	.26	.50	.59	.64	.71	.76	.81
3800	1.35	.27	.52	.62	.68	.75	.82	.86
3900	1.42		.55	.65	.71	.79	.86	.90
4000	1.49		.57	.68	.74	.82	.90	.95
4100	1.57		.60	.72	.78	.87	.95	1.00
4200	1.65		.63	.76	.83	.91	1.00	1.05
4300	1.73			.80	.87	.96	1.05	1.10
4400	1.81			.84	.91	1.00	1.10	1.15
4600	1.98			.91	.99	1.10	1.20	1.25
4800	2.15			.99	1.08	1.19	1.31	1.36
5000	2.34				1.17	1.29	1.42	1.48
5200	2.53				1.26	1.40	1.53	1.60
5400	2.72				1.36	1.50	1.65	1.72
5600	2.93					1.62	1.78	1.86
5800	3.14					1.74	1.91	1.99
6000	3.37					1.86	2.04	2.13

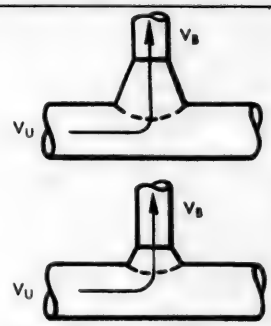
However, when space and structural reasons require the use of rectangular ducts, the dimensions are determined by means of the conventional equivalent diameter tables.

Flexible Round Ducting—Complete pressure loss data on flexible round ducting are not yet available. Further uncertainty is caused by random bends, contraction, suspension distance, and deformation occurring in the course of installation. Consequently, for short lengths (up to 48 inches) friction losses should be approximated as being about 25% above those of equal size rigid metal ducting. Flexible ducting elbows have twice the pressure loss of 5-piece metal elbows. Their center radii should be as large as possible, and in no case less than 1.5 duct diameters ($R/D = 1.5$).

TABLE 2-A—STATIC PRESSURE LOSSES IN 90-DEG BRANCH TAKE-OFFS, INCHES WG.



90° "Long Cone" Type Take-off



90° "Long" or "Short" Take-off

.8	.9	1.0	1.25	1.5	1.75	2.0	2.5	3.0
.007	.009	.011	.015	.018	.021	.023	.024	.025
.013	.016	.02	.027	.032	.037	.04	.042	.044
.02	.025	.031	.042	.051	.058	.063	.066	.069
.029	.036	.045	.06	.073	.084	.09	.095	.099
.039	.049	.061	.082	.099	.113	.122	.128	.134
.051	.065	.08	.107	.13	.149	.16	.168	.176
.065	.082	.101	.135	.164	.188	.20	.21	.22
.080	.101	.128	.167	.20	.23	.25	.26	.27
.088	.111	.138	.184	.22	.26	.28	.29	.30
.097	.122	.151	.20	.25	.28	.30	.32	.33
.105	.133	.165	.22	.27	.31	.33	.35	.36
.115	.145	.18	.24	.29	.33	.36	.38	.40
.124	.158	.195	.26	.32	.36	.39	.41	.43
.135	.171	.21	.28	.34	.39	.42	.44	.46
.145	.184	.23	.30	.37	.42	.45	.47	.50
.156	.198	.24	.33	.40	.45	.49	.51	.54
.168	.21	.26	.35	.43	.49	.52	.55	.58
.18	.23	.28	.38	.46	.52	.56	.59	.62
.19	.24	.30	.40	.49	.56	.60	.63	.66
.20	.26	.32	.43	.52	.59	.64	.67	.70
.22	.27	.34	.45	.55	.64	.68	.71	.74
.23	.29	.36	.48	.58	.67	.72	.76	.79
.24	.31	.38	.51	.62	.71	.76	.80	.84
.26	.33	.40	.54	.65	.75	.81	.85	.89
.27	.35	.42	.57	.69	.79	.85	.90	.94
.29	.37	.45	.60	.73	.84	.90	.95	.99
.30	.39	.48	.63	.77	.88	.95	1.00	1.04
.32	.41	.50	.66	.80	.92	.99	1.05	1.09
.34	.43	.52	.70	.85	.97	1.05	1.10	1.15
.35	.45	.55	.73	.89	1.02	1.10	1.16	1.21
.37	.47	.58	.77	.93	1.07	1.15	1.21	1.27
.39	.49	.60	.80	.98	1.12	1.21	1.27	1.33
.42	.54	.66	.88	1.07	1.23	1.32	1.39	1.45
.46	.58	.72	.96	1.16	1.34	1.44	1.51	1.58
	.63	.78	1.04	1.26	1.45	1.56	1.64	1.71
	.68	.84	1.13	1.37	1.57	1.69	1.77	1.85
	.73	.91	1.21	1.47	1.69	1.81	1.90	1.99
		.98	1.31	1.58	1.82	1.95	2.05	2.15
		1.05	1.40	1.70	1.95	2.10	2.20	2.31
		1.12	1.50	1.82	2.09	2.24	2.36	2.47

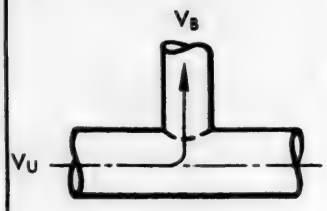
Example: $V_U = 3000$ fpm, $V_B = 2400$ fpm.

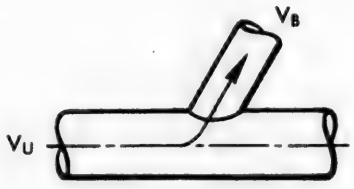
To Find: Static pressure loss for short cone branch take-off.

Solution: $V_B/V_U = 2400/3000 = 0.8$,
Static pressure loss = 0.25 inches wg.

Note: Disregard static pressure losses for short cone design with V_B/V_U below 0.6, and for long cone design below 0.8.

TABLE 2-B—STATIC PRESSURE LOSSES IN BRANCH TAKE-OFFS AT DIFFERENT ANGLES, INCHES WG.





60° Cylindrical Branch Take-off

Branch Duct Vel. V_B fpm	°90 Cylindr. Branch Take-off	V_B/V_U=.5	.6	.7	.8	.9	1.0	1.2	1.4	1.6	1.8
600	.034	.004	.009	.013	.014	.016	.017	.02	.022	.024	.026
800	.06	.008	.016	.022	.026	.028	.031	.035	.039	.043	.046
1000	.094	.013	.026	.035	.04	.044	.048	.054	.061	.067	.073
1200	.135	.018	.037	.05	.057	.064	.069	.078	.088	.096	.104
1400	.183	.024	.05	.068	.078	.086	.094	.106	.12	.131	.142
1600	.24	.032	.066	.09	.102	.113	.123	.139	.157	.171	.186
1800	.30	.04	.083	.113	.129	.143	.156	.176	.198	.22	.23
2000	.37	.05	.102	.139	.159	.177	.192	.22	.24	.27	.29
2100	.41	.055	.113	.154	.176	.195	.21	.24	.27	.29	.32
2200	.45	.06	.124	.169	.193	.21	.23	.26	.30	.32	.35
2300	.49	.066	.135	.184	.211	.23	.25	.29	.32	.35	.38
2400	.54	.072	.147	.20	.23	.26	.28	.31	.35	.38	.42
2500	.58	.078	.159	.22	.25	.28	.30	.34	.38	.42	.45
2600	.63	.084	.173	.24	.27	.30	.33	.37	.41	.45	.49
2700	.68	.091	.186	.25	.29	.32	.35	.40	.44	.49	.53
2800	.73	.099	.20	.27	.31	.35	.38	.43	.48	.52	.57
2900	.79	.105	.21	.29	.34	.37	.40	.46	.51	.56	.61
3000	.84	.112	.23	.31	.36	.40	.43	.49	.55	.60	.65
3100	.90		.25	.34	.38	.43	.46	.52	.59	.64	.69
3200	.96		.26	.36	.41	.45	.49	.56	.63	.68	.74
3300	1.02		.28	.38	.43	.48	.52	.59	.67	.73	.79
3400	1.08		.30	.40	.46	.51	.56	.63	.71	.77	.84
3500	1.15		.31	.43	.49	.54	.59	.66	.75	.82	.89
3600	1.21		.33	.45	.52	.57	.62	.70	.79	.87	.94
3700	1.28		.35	.48	.55	.61	.66	.74	.84	.91	.99
3800	1.35		.37	.50	.58	.64	.69	.78	.88	.96	1.04
3900	1.42			.53	.61	.67	.73	.81	.93	1.01	1.10
4000	1.49			.55	.64	.70	.76	.86	.97	1.06	1.15
4100	1.57			.59	.67	.74	.81	.91	1.03	1.12	1.21
4200	1.65			.62	.70	.78	.85	.96	1.08	1.18	1.27
4300	1.73				.74	.81	.89	1.00	1.13	1.23	1.34
4400	1.81				.77	.86	.93	1.05	1.18	1.29	1.40
4600	1.98				.85	.94	1.02	1.15	1.29	1.41	1.53
4800	2.15				.92	1.02	1.11	1.25	1.41	1.54	1.67
5000	2.34					1.11	1.20	1.36	1.53	1.67	1.81
5200	2.53					1.20	1.30	1.47	1.65	1.80	1.96
5400	2.72					1.29	1.40	1.58	1.78	1.94	2.11
5600	2.93						1.50	1.70	1.91	2.09	2.27
5800	3.14						1.61	1.82	2.05	2.24	2.43
6000	3.37						1.73	1.95	2.20	2.40	2.60

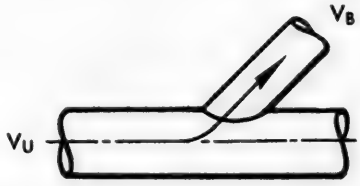
STEP-BY-STEP DESIGN METHOD

A 14-step method for accurate and rapid design of high-velocity, all-air, air conditioning systems is demonstrated by its application to a hypothetical 3-story office building. The schematic layout of the system is shown in Fig. 1. The work sheet is Fig. 2. Air requirements and duct layout for each floor are assumed to be equal.

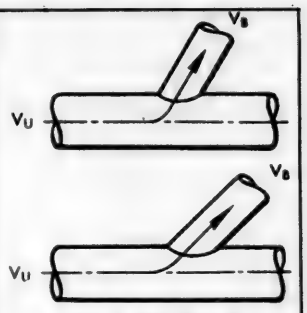
Main Duct

Step 1: Select critical high velocity unit and duct run. Consider capacity and pressure loss characteristics of unit and fittings, as well as duct length. Include branch take-off before critical unit.

TABLE 2-B—STATIC PRESSURE LOSSES IN BRANCH TAKE-OFFS AT DIFFERENT ANGLES, INCHES WG.



45° Cylindrical Branch Take-off



45° or 60° Branch Take-off

.8	.9	1.0	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.5	3.0
.002	.006	.009	.013	.016	.018	.02	.023	.025	.027	.03	.033
.004	.01	.017	.022	.028	.032	.035	.04	.045	.049	.054	.058
.006	.016	.026	.035	.043	.049	.054	.063	.071	.076	.084	.091
.009	.023	.038	.05	.062	.074	.078	.09	.102	.11	.122	.131
.012	.032	.051	.068	.084	.096	.106	.12	.138	.149	.165	.177
.016	.042	.067	.09	.11	.126	.139	.16	.181	.195	.22	.23
.02	.053	.085	.113	.14	.160	.176	.20	.23	.25	.27	.29
.025	.065	.105	.139	.17	.197	.22	.25	.28	.30	.34	.36
.028	.072	.116	.154	.19	.22	.24	.28	.31	.34	.37	.40
.03	.079	.127	.169	.21	.24	.26	.30	.34	.37	.41	.44
.033	.086	.138	.184	.23	.26	.29	.33	.37	.40	.44	.48
.036	.093	.151	.20	.25	.28	.31	.36	.41	.44	.49	.52
.039	.101	.163	.22	.27	.31	.34	.39	.44	.48	.53	.56
.042	.11	.177	.24	.29	.33	.37	.42	.48	.52	.57	.61
.045	.118	.191	.25	.31	.36	.40	.45	.51	.56	.61	.66
.049	.127	.21	.27	.34	.39	.43	.49	.55	.60	.66	.71
.052	.136	.22	.29	.36	.41	.46	.52	.59	.64	.71	.76
.056	.146	.24	.31	.39	.45	.49	.56	.63	.68	.76	.81
.060	.156	.25	.34	.41	.48	.52	.60	.68	.73	.81	.87
.064	.166	.27	.36	.44	.51	.56	.64	.72	.78	.86	.93
.068	.177	.29	.38	.47	.54	.59	.68	.77	.83	.92	.99
.072	.188	.30	.40	.50	.57	.63	.72	.82	.88	.97	1.05
.076	.199	.32	.43	.53	.60	.66	.76	.86	.93	1.03	1.11
.081	.21	.34	.45	.56	.64	.70	.81	.91	.99	1.09	1.17
.085	.22	.36	.48	.59	.67	.74	.85	.97	1.04	1.15	1.24
.09	.23	.38	.50	.62	.71	.78	.90	1.02	1.10	1.22	1.31
.095	.25	.40	.53	.65	.75	.81	.95	1.07	1.16	1.28	1.38
.10	.26	.42	.55	.68	.78	.86	.99	1.12	1.21	1.34	1.44
.105	.27	.44	.58	.72	.83	.91	1.05	1.18	1.28	1.42	1.52
.11	.29	.46	.61	.76	.87	.96	1.10	1.24	1.34	1.49	1.60
.115	.30	.48	.65	.80	.91	1.00	1.15	1.30	1.41	1.56	1.67
.121	.31	.51	.68	.83	.95	1.05	1.21	1.36	1.47	1.63	1.75
.132	.34	.55	.74	.91	1.04	1.15	1.32	1.49	1.61	1.78	1.91
.144	.37	.60	.80	.99	1.13	1.25	1.44	1.62	1.75	1.94	2.08
	.41	.65	.87	1.08	1.23	1.36	1.56	1.76	1.90	2.10	2.26
	.44	.71	.94	1.16	1.33	1.47	1.69	1.91	2.06	2.28	2.44
	.47	.76	1.01	1.25	1.43	1.58	1.81	2.05	2.21	2.45	2.63
		.82	1.09	1.35	1.54	1.70	1.95	2.21	2.38	2.64	2.83
		.88	1.17	1.45	1.66	1.82	2.1	2.37	2.56	2.83	3.04
		.94	1.37	1.55	1.77	1.95	2.24	2.54	2.74	3.03	3.25

Example: $V_U = 3000$ fpm, $V_B = 2400$ fpm.

To Find: Static pressure loss for 90, 60, and 45-deg branch take-offs.

Solution: $V_B/V_U = 2400/3000 = 0.8$

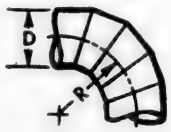
90-deg take-off = 0.54 inches wg.

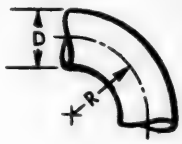
60-deg take-off = 0.23 inches wg, and

45-deg take-off = 0.036 inches wg.

Note: Disregard static pressure losses for 60-deg branch take-offs with V_B/V_U below 0.5, and for 45-deg branch take-offs with V_B/V_U below 0.8.

TABLE 3—STATIC PRESSURE LOSSES IN 90-DEG ELBOWS IN ROUND DUCTS, INCHES WG.





Duct Velocity fpm	Miter Elbows	3 pc. Elbows				5 pc. & Smooth Elbows				
		R/D: .5	.75	1.0	1.5-3.0	.5	.75	1.0	1.5	2.0
600	.029	.022	.012	.009	.007	.02	.01	.007	.005	.004
800	.052	.038	.021	.016	.013	.036	.018	.013	.01	.008
1000	.081	.06	.033	.025	.021	.056	.028	.021	.015	.012
1200	.117	.086	.048	.036	.03	.081	.041	.03	.022	.017
1400	.159	.117	.065	.049	.04	.11	.055	.04	.029	.023
1600	.21	.154	.085	.064	.053	.144	.072	.053	.038	.03
1800	.26	.194	.107	.081	.067	.182	.091	.067	.048	.038
2000	.32	.24	.132	.10	.082	.22	.112	.082	.06	.047
2100	.36	.26	.146	.11	.091	.25	.124	.091	.066	.052
2200	.39	.29	.16	.121	.10	.27	.136	.10	.072	.057
2300	.43	.32	.174	.132	.109	.30	.148	.109	.079	.063
2400	.47	.34	.19	.144	.118	.32	.162	.118	.086	.068
2500	.51	.37	.21	.156	.128	.35	.175	.128	.093	.074
2600	.55	.41	.22	.169	.139	.38	.19	.139	.101	.08
2700	.59	.44	.24	.182	.15	.41	.20	.15	.109	.086
2800	.63	.47	.26	.195	.161	.44	.22	.161	.117	.093
2900	.68	.50	.28	.21	.173	.47	.24	.173	.126	.10
3000	.73	.54	.30	.22	.185	.51	.25	.185	.135	.107
3100	.78	.58	.32	.24	.198	.54	.27	.198	.144	.114
3200	.83	.61	.34	.26	.21	.58	.29	.21	.153	.121
3300	.88	.65	.36	.27	.22	.61	.31	.22	.163	.129
3400	.94	.69	.38	.29	.24	.65	.32	.24	.173	.137
3500	.99	.73	.40	.31	.25	.69	.34	.25	.183	.145
3600	1.05	.78	.43	.32	.27	.73	.36	.27	.194	.154
3700	1.11	.82	.45	.34	.28	.77	.38	.28	.20	.162
3800	1.17	.86	.48	.36	.30	.81	.41	.30	.22	.171
3900	1.23	.91	.50	.38	.31	.85	.43	.31	.23	.18
4000	1.30	.96	.53	.40	.33	.90	.45	.33	.24	.189
4100	1.36	1.01	.56	.42	.35	.94	.47	.35	.25	.20
4200	1.43	1.06	.58	.44	.36	.99	.50	.36	.26	.21
4300	1.50	1.11	.61	.46	.38	1.04	.52	.38	.28	.22
4400	1.57	1.16	.64	.48	.40	1.09	.54	.40	.29	.23
4600	1.72	1.27	.70	.53	.44	1.19	.59	.44	.32	.25
4800	1.87	1.38	.76	.57	.47	1.29	.65	.47	.35	.27
5000	2.03	1.50	.83	.62	.51	1.40	.70	.51	.38	.30
5200	2.19	1.62	.89	.67	.56	1.52	.76	.56	.41	.32
5400	2.36	1.74	.96	.73	.60	1.63	.82	.60	.44	.34
5600	2.54	1.88	1.04	.78	.65	1.76	.88	.65	.47	.37
5800	2.72	2.01	1.11	.84	.69	1.89	.94	.69	.50	.40
6000	2.92	2.15	1.19	.90	.74	2.02	1.01	.74	.54	.43

Example: Determine static pressure drop of 12-in. dia, 90-deg, 5-piece elbow where R = 18 in. It handles 1570 cfm.

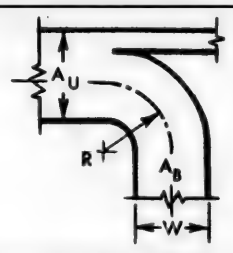
Solution: Velocity (cfm ÷ duct area) = 2000 fpm. R/D = 18/12 = 1.5. Static pressure drop = 0.06 inches. wg.

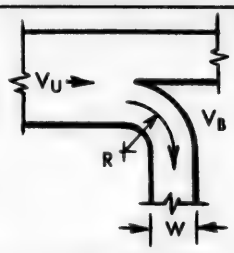
Note: For elbows other than 90 deg, multiply static pressure loss for 90-deg elbow by the angle divided by 90.

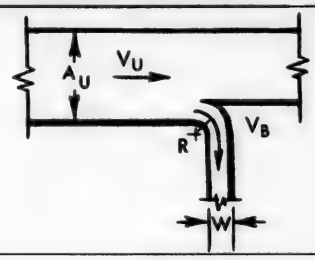
Referring to the schematic layout, Fig. 1, note that Unit **A** is farthest from riser, has low minimum static pressure (SP) loss, one elbow fitting, and may benefit from static regain. Unit **B** has shorter duct run, higher minimum SP, an elbow, and a take-off fitting and less potential benefit from static regain. Unit **B** is, therefore, selected as the critical unit.

For similar reasons, the ducting serving the second floor is selected as part of the main duct run. Proceed to the next step.

TABLE 4—STATIC PRESSURE LOSSES IN 90-DEG BRANCH TAKE-OFFS IN RECTANGULAR DUCTS, INCHES WG.







Branch Velocity, V_B fpm	Aspect Ratio: H/W Area Ratio: A_B/A_U Vel. Ratio: V_B/V_U	.25 — .50 .7 — 1.2 1.2	 1.3	.75 — 3.0 .4 — .6 1.1	 1.2	 1.3	4 — 6 .15 — .3 .9	 1.0	 1.1	 1.2	 1.3
600		.011	.013	.007	.011	.018	.008	.011	.015	.018	.02
800		.02	.024	.013	.02	.032	.015	.02	.027	.032	.036
1000		.032	.038	.020	.032	.051	.023	.031	.042	.05	.057
1200		.046	.055	.028	.046	.073	.033	.045	.061	.073	.082
1400		.062	.074	.038	.062	.099	.045	.061	.082	.098	.111
1600		.081	.097	.05	.081	.129	.059	.08	.108	.129	.145
1800		.102	.123	.063	.102	.163	.074	.101	.136	.163	.183
2000		.126	.151	.078	.126	.20	.091	.125	.168	.20	.23
2100		.139	.167	.086	.139	.22	.101	.138	.185	.22	.25
2200		.153	.184	.095	.153	.24	.111	.151	.20	.24	.27
2300		.166	.20	.104	.168	.27	.121	.165	.22	.27	.30
2400		.182	.22	.113	.182	.29	.131	.18	.24	.29	.33
2500		.197	.24	.122	.197	.31	.142	.195	.26	.31	.35
2600		.21	.26	.133	.21	.34	.154	.21	.28	.34	.38
2700		.23	.28	.143	.23	.37	.166	.23	.31	.37	.41
2800		.25	.30	.153	.25	.39	.179	.24	.33	.39	.44
2900		.27	.32	.165	.27	.42	.192	.26	.35	.42	.48
3000		.28	.34	.176	.28	.45	.21	.28	.38	.45	.51
3100		.30	.36	.188	.30	.48	.22	.30	.40	.48	.54
3200		.32	.39	.20	.32	.52	.23	.32	.43	.52	.58
3300		.34	.41	.21	.34	.55	.25	.34	.46	.55	.62
3400		.36	.44	.23	.36	.58	.26	.36	.49	.58	.65
3500		.39	.46	.24	.39	.62	.28	.38	.51	.62	.69
3600		.41	.49	.25	.41	.65	.30	.40	.54	.65	.73
3700		.43	.52	.27	.43	.69	.31	.43	.58	.69	.78
3800		.46	.55	.28	.46	.73	.33	.45	.61	.73	.82
3900		.48	.58	.30	.48	.77	.35	.47	.64	.77	.86
4000		.51	.61	.31	.51	.81	.36	.50	.67	.81	.91
4100		.53	.64	.33	.53	.85	.38	.52	.71	.85	.95
4200		.56	.67	.35	.56	.89	.40	.55	.74	.89	1.00
4300		.58	.70	.36	.58	.93	.42	.58	.78	.93	1.05
4400		.61	.73	.38	.61	.97	.44	.60	.81	.97	1.10
4600		.67	.80	.41	.67	1.07	.48	.66	.89	1.06	1.20
4800		.73	.87	.45	.73	1.16	.53	.72	.97	1.16	1.30
5000		.79	.95	.49	.79	1.26	.57	.78	1.05	1.26	1.41
5200		.85	1.03	.53	.85	1.36	.62	.84	1.14	1.36	1.53
5400		.92	1.11	.57	.92	1.47	.67	.91	1.22	1.46	1.65
5600		.99	1.19	.61	.99	1.58	.72	.98	1.32	1.57	1.77
5800		1.06	1.27	.66	1.06	1.69	.77	1.05	1.41	1.69	1.90
6000		1.14	1.36	.70	1.14	1.81	.82	1.12	1.51	1.81	2.04

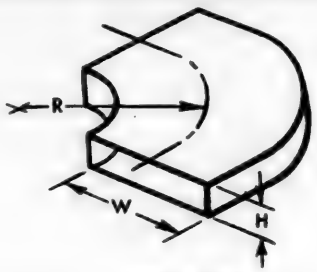
Example: Upstream duct, 24 by 12 inches, handling 5000 cfm; branch duct, 12 by 12, handling 3000 cfm; $A_B/A_U = 0.5$; $H/W = 1.0$; $V_B/V_U = 3000/2500 = 1.2$. Static pressure drop for 3000-fpm branch velocity = 0.20 inches wg.

Note: Radius ratio (R/W) should equal or exceed unity. For branch take-offs with lower velocity ratios (V_B/V_U) use values for elbows of comparable aspect ratio (H/W) and radius ratio of 1.0. See Table 5.

Step 2: Starting at the critical high velocity unit and working upstream, toward the fan, identify and enter in the work sheet, Fig. 2, Columns 1, 2, and 5, the main duct fittings, their cfm and section lengths. (Refer to sections 1 to 5 in the layout, Fig. 1.)

Step 3: Starting with the duct section handling the most cfm, determine duct velocities, diameters, and SP per 100 ft (Columns 3, 4, and 6) by means of a standard air duct friction chart (or equivalent air duct calculator slide rule). For example:

TABLE 5—STATIC PRESSURE LOSSES OF 90-DEG ELBOWS IN RECTANGULAR DUCTS, INCHES WG.



HARD BEND

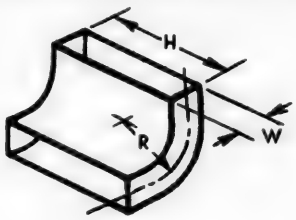
Duct Velocity fpm	Aspect Ratio H/W	.25				.80			
	Radius Ratio R/W	.75	1.0	1.5	2-3	.75	1.0	1.5	2-3
600		.012	.010	.006	.005	.01	.006	.004	.003
800		.022	.018	.011	.009	.018	.011	.007	.006
1000		.034	.028	.017	.015	.028	.017	.011	.009
1200		.049	.04	.025	.021	.04	.025	.015	.013
1400		.066	.054	.033	.028	.054	.034	.021	.018
1600		.086	.07	.044	.037	.07	.044	.027	.023
1800		.109	.089	.055	.047	.089	.056	.035	.029
2000		.13	.11	.068	.058	.11	.069	.043	.036
2100		.149	.121	.075	.064	.121	.076	.047	.04
2200		.163	.133	.083	.07	.133	.084	.052	.044
2300		.178	.145	.09	.076	.145	.091	.056	.048
2400		.194	.158	.098	.083	.158	.10	.061	.052
2500		.21	.17	.107	.09	.17	.108	.067	.056
2600		.23	.186	.116	.098	.186	.114	.072	.061
2700		.25	.20	.124	.105	.20	.126	.078	.066
2800		.26	.21	.134	.113	.21	.136	.083	.071
2900		.28	.23	.144	.122	.23	.146	.090	.076
3000		.30	.25	.154	.13	.25	.156	.096	.081
3100		.32	.26	.164	.139	.26	.167	.102	.087
3200		.35	.28	.175	.148	.28	.178	.109	.093
3300		.37	.30	.186	.158	.30	.189	.116	.098
3400		.39	.32	.198	.167	.32	.20	.123	.105
3500		.41	.34	.21	.177	.34	.21	.131	.111
3600		.44	.36	.22	.187	.36	.22	.138	.117
3700		.46	.38	.23	.198	.38	.24	.146	.124
3800		.49	.40	.25	.21	.40	.25	.154	.131
3900		.51	.42	.26	.22	.42	.26	.162	.138
4000		.54	.44	.27	.23	.44	.28	.17	.144
4100		.57	.46	.29	.24	.46	.29	.179	.152
4200		.59	.48	.30	.26	.48	.31	.188	.16
4300		.62	.51	.32	.27	.51	.32	.197	.167
4400		.65	.53	.33	.28	.53	.34	.21	.175
4600		.71	.58	.36	.31	.58	.37	.23	.191
4800		.78	.63	.39	.33	.63	.40	.25	.21
5000		.84	.69	.43	.36	.69	.43	.27	.23
5200		.91	.74	.46	.39	.74	.47	.29	.24
5400		.98	.80	.50	.42	.80	.51	.31	.26
5600		1.06	.86	.54	.45	.86	.54	.33	.28
5800		1.13	.92	.57	.49	.92	.58	.36	.30
6000		1.21	.99	.61	.52	.99	.62	.38	.33

Example: An elbow in a 24 by 8 inch duct with 12-inch center radius handles 2800 cfm. Equivalent diameter is 14.75 inches; velocity is 2400 (previously calculated). H/W = 24/8 = 3.0; R/W = 12/8 = 1.5; and static pressure drop = 0.047 inches wg.

Main duct, Section 5 ..... 7650 cfm;
Initial velocity (Column 3) ..... 4400 fpm;
Duct diameter (Column 4) ..... 18 inches;
SP per 100 ft (Column 6) ..... 1.3 in. wg.

Step 4: Determine preliminary SP losses (Column 8).
(a) Refer to manufacturers' literature for high velocity units' minimum SP resistance.
(b) Multiply duct length by friction SP loss per 100 ft

TABLE 5 (CONTINUED)—LOSSES IN 90-DEG ELBOWS, RECTANGULAR DUCTS, INCHES WG.



EASY BEND

Duct Velocity fpm	Aspect Ratio H/W	.75-3.0				4-6			
	Radius Ratio R/W	.75	1.0	1.5	2-3	.75	1.0	1.5	2-3
600		.008	.005	.003	.002	.007	.004	.003	.002
800		.014	.008	.005	.004	.013	.007	.005	.004
1000		.023	.013	.008	.007	.020	.011	.007	.006
1200		.032	.019	.012	.01	.029	.017	.01	.009
1400		.044	.026	.016	.013	.039	.023	.014	.012
1600		.058	.034	.021	.018	.051	.030	.018	.016
1800		.072	.042	.026	.022	.064	.037	.023	.02
2000		.09	.052	.032	.027	.079	.046	.028	.024
2100		.099	.058	.036	.030	.087	.051	.031	.026
2200		.109	.063	.039	.033	.096	.056	.034	.029
2300		.118	.069	.043	.036	.104	.061	.038	.032
2400		.129	.075	.047	.039	.114	.066	.041	.035
2500		.14	.082	.051	.043	.123	.072	.044	.038
2600		.152	.089	.055	.046	.134	.078	.048	.041
2700		.163	.095	.059	.050	.144	.084	.052	.044
2800		.176	.102	.063	.054	.155	.09	.056	.047
2900		.189	.11	.068	.058	.166	.097	.060	.051
3000		.20	.118	.073	.062	.178	.104	.064	.054
3100		.22	.126	.078	.066	.19	.111	.068	.058
3200		.23	.134	.083	.07	.20	.118	.073	.062
3300		.24	.143	.088	.075	.22	.126	.077	.066
3400		.26	.151	.094	.079	.23	.133	.082	.07
3500		.28	.16	.099	.084	.24	.141	.087	.074
3600		.29	.17	.105	.089	.26	.149	.092	.078
3700		.31	.179	.111	.094	.27	.158	.097	.083
3800		.32	.189	.117	.099	.29	.167	.103	.087
3900		.34	.199	.123	.104	.30	.176	.108	.092
4000		.36	.21	.129	.109	.32	.184	.113	.097
4100		.38	.22	.136	.115	.33	.194	.12	.102
4200		.40	.23	.143	.121	.35	.20	.125	.107
4300		.42	.24	.15	.127	.37	.21	.131	.112
4400		.43	.25	.157	.133	.38	.22	.138	.117
4600		.48	.28	.172	.145	.42	.24	.15	.128
4800		.52	.30	.187	.158	.46	.27	.164	.139
5000		.56	.33	.20	.171	.49	.29	.178	.151
5200		.61	.35	.22	.185	.53	.31	.192	.164
5400		.65	.38	.24	.20	.58	.34	.21	.176
5600		.70	.41	.25	.21	.62	.36	.22	.19
5800		.75	.44	.27	.23	.66	.39	.24	.20
6000		.81	.47	.29	.25	.71	.42	.26	.22

Note: Rectangular elbows with radius ratio below 0.5 not recommended for high velocity work. Aspect ratios below 0.25 and above 6.0 should be avoided.

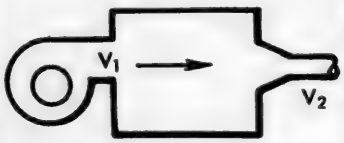
Elbows other than 90 deg cause a drop in static pressure equal to tabular value times the angle divided by 90.

Static pressure losses of rectangular elbows with low radius ratio can be reduced by use of turning vanes. Correction factors are given in table. Values not shown indicate no static pressure drop reduction due to vanes.

R/W	Number of Turning Vanes		
	1	2	3
.75	.43	.32	.25
1.0	.56	.46	—
1.5	.85	—	—

TABLE 6—STATIC PRESSURE LOSS AND REGAIN, FAN-PLENUM-DUCT TRANSITIONS, INCHES WG.

I "Blow-Through" Fan System

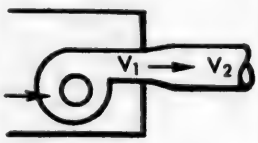


*SP Loss, "wg:

$L = VP_2 \times C_2 - VP_1 \times C_1$

II "Draw-Through" Fan System

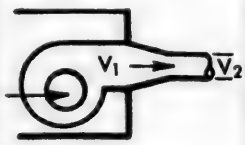
a. Divergent Transition



SP Regain, "wg:

$R = (VP_1 - VP_2) \times C_1$

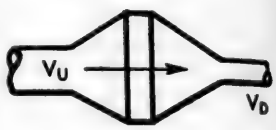
b. Convergent Transition



SP Loss, "wg:

$L = VP_2 \times C_2 - VP_1$

III Heat Exchanger



SP Loss, "wg:

$L = (VP_D - .02)C_2 - (VP_U - .02)C_1$

Velocity V, fpm—Velocity Pressure VP, in wg

V	VP	V	VP	V	VP	V	VP
600	.023	2300	.33	3300	.68	4300	1.15
800	.04	2400	.36	3400	.72	4400	1.21
1000	.062	2500	.39	3500	.77	4600	1.32
1200	.09	2600	.42	3600	.81	4800	1.44
1400	.122	2700	.46	3700	.85	5000	1.56
1600	.16	2800	.49	3800	.90	5200	1.69
1800	.20	2900	.53	3900	.95	5400	1.82
2000	.25	3000	.56	4000	1.00	5600	1.96
2100	.28	3100	.60	4100	1.05	5800	2.10
2200	.30	3200	.64	4200	1.10	6000	2.25

"C" Factor Table

Transition	C_1	C_2
Abrupt enlargement	.18	—
Abrupt contraction	—	1.47
Gradual enlargement 30°	.44	—
(Divergent transition), 45°	.33	—
Included Angle: 60°	.26	—
Gradual contraction (Convergent transition)		
30°—60° Incl. Angle	—	1.07
"Bellmouth"	—	1.05

Examples

I "Blow-Through" Fan

Fan outlet velocity, $V_1 = 3000$ fpm; main duct velocity, $V_2 = 4400$ fpm. Both transitions (fan-plenum and plenum duct) of 60-deg included angle. $VP_1 = .56$, $VP_2 = 1.21$, $C_1 = .26$, $C_2 = 1.07$; static pressure loss $= 1.21 \times 1.07 - .56 \times .26 = 1.15$ inches wg.

II-a "Draw-Through" Fan

$V_1 = 5000$ fpm, $V_2 = 4200$ fpm, 45-deg divergent transition (fan-duct). $VP_1 = 1.56$, $VP_2 = 1.10$, $C_1 = .33$; regain: $(1.56 - 1.1) \times .33 = .152$ inch wg.

II-b "Draw-Through" Fan

$V_1 = 3000$ fpm, $V_2 = 4200$ fpm, 45-deg convergent transition (fan-duct). $VP_1 = .56$, $VP_2 = 1.10$, $C_2 = 1.07$; static pressure loss: $1.1 \times 1.07 - .56 = .617$ inch wg.

III Reheater Coil Section

$V_U = 3800$ fpm, $V_D = 4600$ fpm. Both transitions at 45-deg included angles. $VP_U = .9$, $VP_D = 1.32$, $C_1 = .33$; $C_2 = 1.07$; static pressure loss: $(1.32 - .02) \times 1.07 - (.9 - .02) \times .33 = 1.1$ inch wg.

Note: Static pressure losses due to conventional return duct systems are calculated in the customary manner. Static pressure losses due to equipment, such as filters, coils, etc. are determined according to manufacturer's literature. To determine fan motor hp all pressure losses must be considered.

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and divide by 100. For example, Section 5:

Length (Column 5) ..... 16 ft;
SP per 100 ft (Column 6) ..... 1.3 in. wg;
SP loss, (Column 8) ..... 0.208 in. wg.

(c) Refer to Table 3 for elbow losses. For example:

Duct Section 1, velocity, (Column 3) .. 2800 fpm;
90°, 5-piece elbow, radius ratio, **R/D** .. 1.5;
Elbow SP loss (Column 8) ..... 0.117 in. wg.

(d) Refer to Table 2-A or 2-B for branch take-off losses. For example:

Duct Section 1, branch velocity, V_B . 2800 fpm;
Duct Section 2, upstream velocity, V_U 2500 fpm;
Velocity ratio, V_B/V_U (Column 7) .. 1.12;
Short cone take-off loss (Column 8) . 0.425 in. wg.

(e) Refer to manufacturers' literature for SP ratings of primary equipment, such as coils and filters, and determine losses due to fresh-air intakes, return ducts, etc., by separate calculation.

Step 5: Determine SP losses (Column 9) and regain (Column 10) due to velocity conversion.

(a) Refer to Table 1 for the duct system proper. For example, Duct Section 4:

Upstream velocity in Section 5 (Column 3) V_U ..... 4400 fpm;
Downstream velocity in Section 4 (Column 3) V_D ..... 3700 fpm;
Regain (Column 10) ..... 0.28 in. wg;

(b) Refer to Table 6 for fan-plenum-duct transitions. For example, fan-plenum Arrangement II-a:

Static regain, $R = (VP_1 - VP_2) \times C_1$, in. wg;
Fan discharge velocity $V_1 = 5000$ fpm;
From the table, $VP_1 = 1.56$ in. wg;
Initial duct velocity, $V_2 = 4400$ fpm;
From the table, $VP_2 = 1.21$ in. wg;
From C-Factor table,
C_1 for 30° divergent transition $= 0.44$;
Enter static regain (Column 10) $= 0.154$ in. wg.

Step 6: Add up pressure losses (Columns 8 and 9) and deduct regain (Column 10) for each section to obtain sectional SP losses (Column 11).

Step 7: Determine cumulative SP losses (Column 12) by adding up sectional losses, step by step, starting with Section 1. The highest value obtained represents the tentative SP drop for the entire system, subject to recheck of other branch trunk ducts, as outlined in Step 8.

Branch Trunk Ducts

Step 8: Determine the static pressure available for designing the branch duct. It is equal to the pressure in the main duct at the junction and, therefore, also to the sum of pressure losses downstream of the take-off.

From Columns 1 and 12 of the main duct calculations, identify and enter in the work sheet the main duct section following the branch take-off (Column 13) and available SP at the take-off (Column 14). For example:

(Refer to layout, Fig. 1.) Main duct Section 2 follows junction of branch trunk duct, Sections 8 to 10.
(Refer to work sheet, Fig. 2.) Available SP at take-off = cumulative SP drop for duct Section 2 = 1.333 inches wg.

Step 9: Branch trunk ducts, resembling a portion of the main duct in layout and capacity, often require rechecking of only one fitting and/or duct section against available SP. Check particularly for:

(a) Low available SP .. Check main duct, Column 12;
(b) High V_B/V_U ratio .. Check Columns 3 and 7;
(c) Longest duct run .. Check Column 5.

For example, referring to layout and work sheet for Section 7:

Duct layout and cfm for 3rd floor are equal to previously calculated main duct Sections 1 to 3.

Available SP (Column 14) = 1,497 in. wg. Note that this is a lower value than that for the 2nd floor.

Branch SP losses (Column 12) = 1.405 in. wg. due to low V_B/V_U ratio, take-off losses are disregarded. See Table 2-A.

Available SP exceeds branch duct losses. Therefor, no changes are required. (Should branch duct losses exceed available SP, increase fan SP rating by a corresponding amount or select fittings or high velocity terminal with lower resistance.

Step 10: Design branch trunk ducts with different cfm and dimensions, as follows: Determine location of take-off and available SP, as before, (Columns 13 and 14). Enter on work sheet the branch duct sections, fittings, and high velocity unit, their cfm and section lengths, as before (Columns 1, 2, and 5) but omit fitting details. An example is provided on the work sheet for Duct Sections 8 to 12.

Step 11: Determine duct velocities, diameters, SP per 100 ft, V_B/V_U ratios, friction losses, conversion losses and regain, and high velocity unit minimum SP resistances, as before, (Columns 3, 4, 6, 7, 8, 9, and 10) but omit fitting losses. Add up values, entered in Columns 8 and 9 so far, and deduct those in Column 10. Subtract the result from the available SP, (Column 14) to obtain the pressure available for the fittings.

Step 12: Select fitting details from Tables 2-A, 2-B and/or 3. Enter them and their SP losses on the work sheet (Columns 1 and 8). Add up sectional and cumulative SP losses, as before (Columns 11 and 12). As an example, refer to work sheet for duct sections 8 to 10.

Single Branch Lines

Step 13: Enter take-off location and available SP from previously established data (Columns 13 and 14); also terminal, duct section, and duct length, according to layout (Columns 1, 2, and 5); duct velocity, diameter, SP per 100 ft, and V_B/V_U, according to the high velocity unit selected and an air duct friction chart (Columns 3, 4, 6, and 7).

Step 14: Determine duct friction and minimum high velocity SP loss (Column 8), also conversion loss or regain, wherever applicable (Columns 9 and 10). Finally, check fitting details and SP losses (Columns 1 and 8) and sectional pressure losses (Column 11) against available SP (Column 14).

References

1. Table I—"Branch Fitting Performance at High Velocity", by C. M. Ashley, S. F. Gilman and R. A. Church, *ASHAE Transactions* No. 1571, Vol. 62, 1956, pp. 279-294, especially Fig. 6, Curve H and Fig. 7; also *Fan Engineering*, 5th edition, p. 126.

2. Tables II-A and II-B — Reference 1, Figs. 9 and 10, and "Pressure Losses of Divided-Flow Fittings", by S. F. Gilman, *ASHAE Transactions* No. 1538, Vol. 61, 1955, pp. 281-296, especially Fig. 7.

3. Table III—1957 *ASHAE GUIDE*, Chapter 31, Air Duct Design, Table 2, p. 790 and Fig. 8, p. 793.

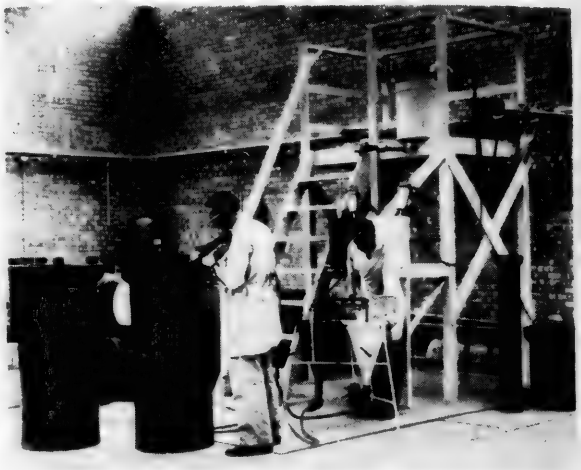
4. Table IV—"Resistance of Rectangular Divided-Flow Fittings", by L. G. Miller, C. H. Pesterfield and R. J. Waalkes, *ASHAE Transactions* No. 1563, Vol. 62, 1956, pp. 145-158.

5. Table V—*Fan Engineering*, 5th edition, pp. 147-152.

6. Table VI—*Fan Engineering*, 5th edition, pp. 115-132; also 1957 *ASHAE GUIDE*, Chapter 31, Air Duct Design, Table 3, p. 791.

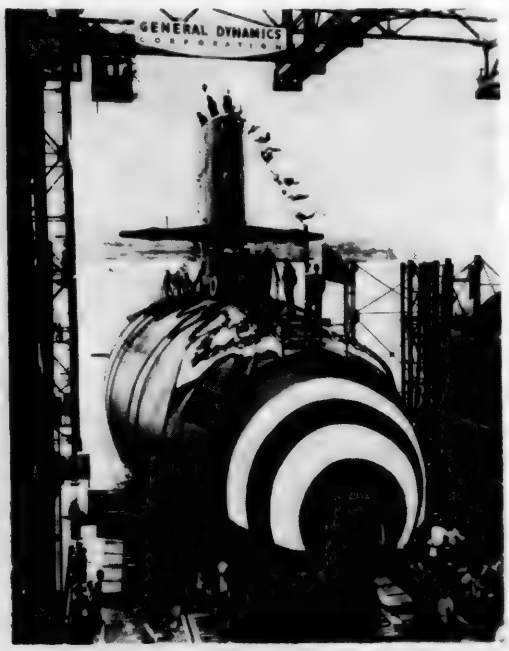
SOLAR HOUSE. (Left) This is the erected version of the solar house designed by first-prize winner Peter R. Lee in the 1957 International Architectural Competition, and described in the May issue of *Air Conditioning, Heating and Ventilating*. The deluge of visitors, both professional and non-professional, caused neighbors to protest, resulting in closing of the house. Directors of Association for Applied Solar Energy are attempting to obtain museum status for house so that it can at least be shown to select groups. Simultaneously, house is being offered for sale as private dwelling.

Picture Paragraphs

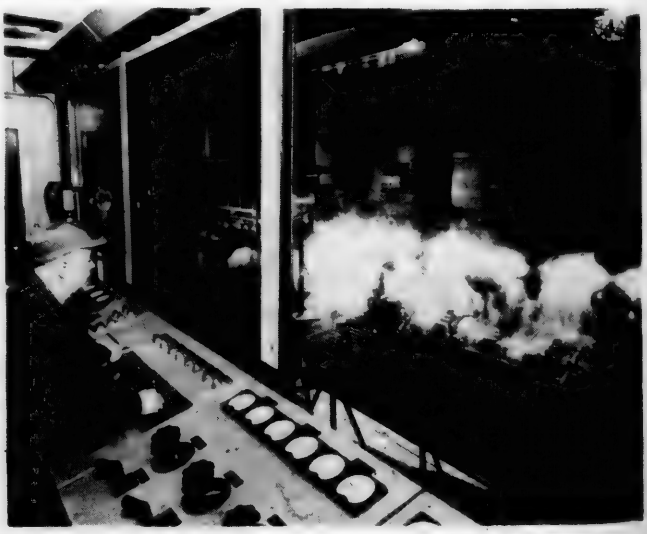


CLAY PIPE RESEARCH. (Right) Two members of the National Clay Pipe Manufacturers, Inc., research staff are shown conducting an experiment with vitrified clay pipe in the recently-dedicated D. M. Strickland Research Laboratory at Crystal Lake, Ill. Primary research aim is directed to new materials and techniques for the jointing of vitrified clay pipe.

ATOMIC SUBMARINE. U. S. Navy's fourth atomic submarine, high-speed attack-type *Skipjack*, carries air conditioning and refrigerant control valves designed and manufactured by Alco Valve Company of St. Louis.



CONTINUOUS WELD PIPE. Employee at the Aliquippa, Pa., Works of Jones & Laughlin Steel Corp. controls operations of the welding and forming stands at company's new continuous weld pipe mill. From hot strip in widths ranging from 6¾ to 17½ inches, two automated continuous weld mills produce a quality pipe ranging in diameter from ½ through 4 inches.



Designing for Welded Systems of Small Size Pipe

A. N. KUGLER

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Division of Air Reduction Company, Inc.

Because small diameter pipe involves problems peculiar to these sizes, it is necessary to design specially for these conditions. In addition, it is important to organize the job on the basis of the small pipe, in order to achieve maximum economy. An article by Mr. Kugler the previous month covered fabrication of small piping by welding and brazing, serves as introductory material.

DESIGN of joints for pipe welding has been well established and is largely based upon metal thickness. For pipe metal thickness under 5/32 inch the edge as left by most pipe cutting tools is satisfactory preparation for welding. However, if metal thicknesses increase above 5/32 inch it becomes necessary to resort to special preparation in the form of bevels or grooves. The design of such bevels and grooves for large diameter welded pipes are quite involved and sometimes quite costly. Fortunately for small diameter pipe, metal thickness is usually well below the range involving these complex joint preparations.

Using 4-inch standard weight pipe as the limitation of pipe sizes covered by this discussion, it will be evident that metal thicknesses do not exceed ¼ inch—as a matter of fact for 4-inch pipe it is 0.237 inch. Pipe up to 2-inch nominal diameter is less than 3/16 inch thick; actually pipe up to 2-inch diameter is not quite 5/32 inch thick. Therefore, the bulk of the small diameter pipe falls in the range involving the square groove butt joint. Such a joint would normally be used on sheet metal but in the case of piping we can secure help through the use of the usual pipe cutter. The ends of pipe which have been severed by means of a three-wheel cutter, usually have a small bevel amounting to about 10 deg; thus two such pipe ends placed together would in effect create a 20 deg vee as illustrated in Fig. 1. This slight bevel provides an excellent joint preparation for all pipe sizes up to and including 2-inch. For pipe sizes 2½-inch and larger the standard 37½ deg bevel providing a 70 deg V as pictured in Fig. 2, will be needed.

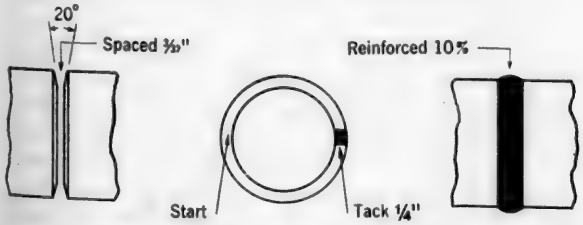
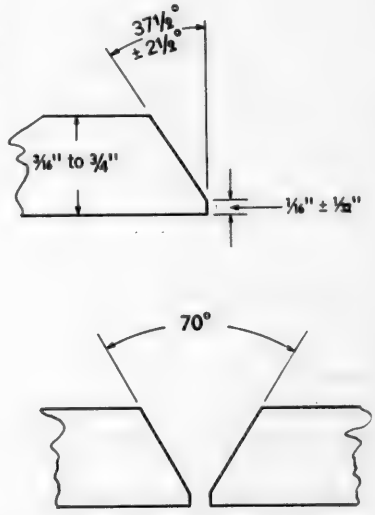


Fig. 1. Preparation of small size pipe ends for welding and completed weld.

The small diameter pipe up to 2-inch should be spaced apart about 3/32 inch after tack welding. Spacing for the larger pipe sizes above 2½-inch should be not less than ⅛ inch after tack welds have cooled. A single tack weld may be employed to hold a pipe in alignment providing that the pipe is not moved and that welding is started within a short time. The weld is initiated at a point diametrically opposite the tack weld. If a number of lengths of pipes are to be tack welded, and moved around, or if there is any chance that the single tack

Fig. 2. Bevel angle and vee groove for pipe wall thicknesses of 3/16 to 3/4 inch.



may be broken, then not less than 2 tack welds 180 deg apart will be necessary to preserve alignment. On the larger diameters of pipe, it may even be necessary to employ three tack welds spaced 120 deg apart.

As a guide, in the case of steel and iron pipe, to the requirements for oxyacetylene welding rods and time to produce a weld, Table I is provided. The figures listed in this table are for actual welding and no provision is made for any lost time or wastage of material. In short, these figures should be increased in terms of a contractor's experience before using them as a basis for estimating. The welds as shown include about 10% reinforcement.

In fabricating assemblies of large diameter piping it is always good practice to utilize seamless welding tees and ells for changes in direction and for branch lines. For the small diameter pipe, in low pressure service it is frequently satisfactory and more economical to resort to bends in the pipe for changes in direction and the direct

TABLE I—REQUIREMENTS FOR OXYACETYLENE WELDS

Pipe Size, Inch Dia	Tip No.	Pressure, Psi		Cons. Cu Ft		Rod, Ozs	Time, Min.
		Oxy.	Acet.	Oxy.	Acet.		
				Per Weld			
½	3	3	3	0.2	0.2	0.107	1.2
¾	3	3	3	0.46	0.46	0.187	2.8
1	3	3	3	0.64	0.64	0.233	3.9
1¼	3	3	3	0.87	0.87	0.562	5.3
1½	3	3	3	1.26	1.26	0.678	7.6

welding of pipes for tee intersections. The bending of small diameter pipe cold is not a very difficult operation in either shop or field if the radius of the bend is equal to about 5 or 6 times the pipe diameter. For shop use there are a number of pipe benders which do an admirable job; for field operations a device such as the conventional electrician's "hickie" is a good tool. Miter joints may also be used for changes in direction. Tee intersections for small piping sizes are so small they do not require the use of templates for welding for sizes below 2-inch. They can be formed by welding one section to the other. In making tee intersections the hole in the run may be drilled or cut with the cutting torch. In the latter case, be sure to remove all slag and loose metal. For pipe 2-inch and larger, better results will be obtained by the use of seamless fittings or pipe templates.

Where threaded valves or other threaded equipment must be connected, it is a simple matter to weld on a threaded nipple, either as a straight run or a tee, to care for such conditions. A stock of threaded nipples, in various sizes and lengths will take care of this condition.

Brazing Design

Design of joints for brazing is quite simple since much of the detail is covered in the many manufactured fittings available. For maximum strength the length of the lap should be three times the thickness of the thinner member joined. Since most brazing fittings are designed for use with pipe, the lap is prepared in terms of pipe thickness. This is, of course, more than adequate when iron pipe size outside diameter (IPSOD) tubing is used since this is thinner than pipe.

Cast brass (usually red brass analysis) fittings are available for both pipe and IPSOD tubing, in patterns ranging from couplings, ells and tees through the various reducing modifications of these basic patterns. One type of fitting has the brazing filler metal preplaced in a groove about midway in the bore. This brazing filler metal (BCuP 5) is inserted at the time of manufacture. For installation, after cleaning and fluxing both pipe and fittings, it is necessary to heat both the pipe and the fitting to effect a flowing of the brazing filler metal, thus making the joint.

Another type of fitting, available in the usual wide range of patterns, is manufactured in red brass and malleable iron. These fittings, Fig. 3, are designed for face feeding of the filler metal—this means that after cleaning and fluxing, the assembled joint is heated with an oxyacetylene torch and the filler metal, hand held, is introduced in the joint at the proper temperature. With this design of fitting a wider selection of filler metals is possible. For assemblies of brass and copper pipe and tubing, filler metals may be of the BAg or BCuP classifications. For iron and steel pipe with malleable iron fittings only, the BAg group of alloys should be used. Whenever dissimilar metal combinations are encountered, particularly if one element is iron or steel, use only the BAg alloys. Generally filler metal of the BAg 1 classification is preferred for this work.

Under some circumstances it may be desirable to employ both welding and brazing on one assembly. Thus where butt joints are involved in straight runs, welding is a logical solution since no fittings are required. However, when it is necessary to change direction (ells), provide for branches (tees) or reduce pipe size (reducers), brazed fittings may be employed to expedite construction.

Welding and Brazing Various Pipe Metals

In a previous article (Aug., 1958, ACH&V), the filler metals for use with the various base metals, with specific welding processes, were indicated. It is now appropriate to discuss the various means of installing piping systems of the several metal types.

Steel and Iron Pipe Systems

It is generally conceded that oxyacetylene welding is the best and most economical method of installing small sizes of steel and iron pipe, particularly if butt welding is necessary. Bending the pipes and direct welding of branches provide for economical assembly; threaded nipples are also helpful for connections to equipment. However, where relatively large headers are involved, the branches are better arc welded to reduce distortion and produce an economical unit. Where it is necessary to resort to arc welding small diameter pipe, more favorable results will be obtained by using the socket type welding fittings. Brazing with the malleable type fittings should not be overlooked when considering means for joining steel or iron pipes. Galvanized pipe is best braze welded with the brass rods, particularly if it is desired to minimize the effects of welding on the galvanizing.

Copper and Copper Alloys

Service conditions will largely dictate the method of connection for copper and copper alloy pipes and tubing. Where welding is essential, then either oxyacetylene or gas shielded tungsten arc welding are the preferred processes, since either may be used for all-position welding. While gas shielded tungsten arc welding does not require flux, it is not useful with high zinc (above about 5% Zn) compositions because the zinc fumes contaminate the arc. Oxyacetylene welding is capable of handling the high zinc compositions with appropriate fluxes. In addition, the oxyacetylene flame inherently produces the preheat necessary with these metals of high conductivity. Metal arc welding may be used but is limited to the flat position. Brazing is probably the most generally suitable process for copper and copper alloy pipes and tubing provided the presence of the brazing filler metal does not create a corrosion problem. It should also be appreciated that joining copper and some of the alloys with

filler metals such as copper-zinc and aluminum bronze is really braze welding and may create corrosion problems.

Nickel and Nickel Alloys

Joining systems involving nickel and nickel alloy pipes and tubing of small diameters is complicated by the fact that the metals are generally used for severe service conditions involving corrosion. Therefore, the metal in the joint should match closely the metal of the pipe or tube. Gas shielded tungsten arc welding is probably the best process to use. Metal arc welding with covered electrodes of matching analysis is also suitable. Oxyacetylene welding with matching welding rods and suitable fluxes is also a satisfactory method. Brazing with the BAg types of filler metals is very satisfactory if the presence of the brazing filler metal is not objectionable from the corrosion standpoint.

Stainless Steels

Stainless steel tubes (very little pipe is used, particularly in small sizes) are employed because of their ability to withstand particularly severe types of service conditions. Therefore, any filler metals used should be of the same composition as the tube or the next higher alloy range. Inert gas-tungsten arc welding is the preferred method and may be used in all positions. Metal arc welding may be used but it is difficult to manipulate on the small sizes of tubes. Brazing is very satisfactory if the brazing filler metal, usually a BAg type, does not cause any corrosion problems. Oxyacetylene welding is seldom used because of the possibility of introducing carbon which can adversely affect the corrosion resistance. Oxyacetylene welding requires the use of a suitable stainless steel welding flux.

Aluminum and Aluminum Alloys

Aluminum and the weldable aluminum alloys are best welded by the gas shielded tungsten arc process using an ac welding power source with continuous high frequency. Oxyacetylene welding is also practical but suitable welding flux must be used; all flux residue must be removed after welding as it is highly corrosive. Both of these processes are suitable for all position welding. Welding rods should be of classifications R-990A or R-S5B depending upon the base metal of the tubes. The classifications are set forth in Tentative Specifications for Aluminum and Aluminum Welding Rods and Bare Electrodes AWS A5.10-54T, ASTM B285-54T. Metal arc welding is seldom used as it is limited to flat position welding. Certain aluminum alloys may be brazed cut; since there are no fittings on the market designed for brazing, this process is not used.

Fig. 3. Manual oxyacetylene torch brazing of steel pipe to malleable iron brazing fittings, using face fed silver base brazing filler metal.

Conclusion

Small diameters of pipe and tubing are widely used for many varied classes of service. Therefore, it is quite natural that the inherent advantages of the welded pipe system should be desired for such small pipe installations. This is possible of achievement by utilizing standard welding procedures long established, together with certain fabricating techniques equally well used.

Driving in Hot Car Increases Accidents

Exposure to hours of hot, summer driving brings about an emotional change and increases the danger of driving, according to a two weeks' test conducted by the O. A. Sutton Corp., Wichita, Kans.

Two 19-year-old athletes of identical size and weight made a daily round trip from Pheonix to Yuma, Ariz., in identical cars, one air conditioned and the other not. The object was to show the effect of air conditioning on driver fatigue.

Among the precautions suggested by the experiment was a reappraisal of highway speed limits during the summer and a possible decrease in maximum speeds during later hours of the day, which is the period commonly known, when the motorist tires.

The tests showed that drivers of air conditioned cars enjoy a 16% increase in depth perception while the driver of the non-conditioned car lost 28% depth perception.

During the depth perception tests, average temperatures ranged from 104 to 113 deg. On a 104 deg day, the non air conditioned car's interior reached a temperature of 119 deg. In addition to damage to vision and reflex, the driver of the hot car suffered abdominal cramps and fuzzy vision several hours after completing the day's drive. He also complained that sun glare on bright colored cars ahead of him, as well as sun reflections off chromium plated bumpers produced a feeling of self hypnosis on several occasions.

Surveys have shown that 41.6% of all fatal accidents were of the non-collision variety, involving no other error but poor judgment on the part of the driver. Faulty depth perception in judging oncoming traffic while passing or calculating speed at turns is a major factor in this type of accident. A car going 60 mph is covering 88 fps so that at this speed, even small errors in judgment are magnified into frightening danger.

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Installation of Exterior Piping

WHEN the installation of a sanitary, storm or combined sanitary and storm system is contemplated, it is very important, in addition to proper pipe sizing, to make sure that the piping will be carefully installed in the earth. The type soil existing at a site where the exterior piping is to be installed is of vital concern to the engineer. Unstable soil conditions require that every precaution be taken to insure that the piping will not sag after installation.

When piping sags, two dangerous conditions develop: (1) The more serious condition results due to rupture of the piping at the point of sagging, with its resulting washout; (2) the less serious result of pipe sagging causes a reduced area for flow in the piping. This condition defeats the purpose of an adequately sized line. All such dangers can be avoided when the piping is supported carefully in the first place.

Typical Installation

An example of a typical piping installation is shown in Fig. 1, where the piping is run to serve a group of apartment houses. The exterior system may be a sanitary, storm or even a combination sanitary and storm system. Let us assume that a combination sanitary storm system is utilized. The line is extended from each building to the manhole as shown. The lines are then combined and run to the point of termination at the outside facilities.

Piping Materials

There are a number of different piping materials that can be used for exterior piping systems. Materials most frequently used are:

1. Asbestos-cement pipe
2. Bituminized-fiber pipe
3. Cast iron soil pipe
4. Concrete sewer pipe
5. Vitrified-clay pipe

The choice of which material to use is dependent upon a number of factors and the judgment of the engineer with regard to the particular site and the capacity of the required piping system. In many areas, the local plumbing department, sewer department, or highway department will prescribe the type piping that should be used.

Whenever any of the piping materials listed are considered for a project, it is always good practice to consult with such pipe manufacturers to obtain their recommendations concerning use, method of joining, and other helpful data to enable the engineer to provide a well designed and a carefully installed system. Also, available, are handbooks which contain a wealth of information regarding the materials listed. Booklets may be obtained by writing to a particular manufacturer or by writing to the association of manufacturers for each of the above materials.

Types of Installations

Under normal conditions, piping can be installed in one of several different ways and Fig. 2, shows three of the most common methods.

Detail *A* shows the piping in a trench that has been carefully dug and graded in stable soil. Bell holes are provided for the hubs so the piping is firmly supported for its entire run. When the backfill in this instance is carefully applied and tamped, a good installation will result.

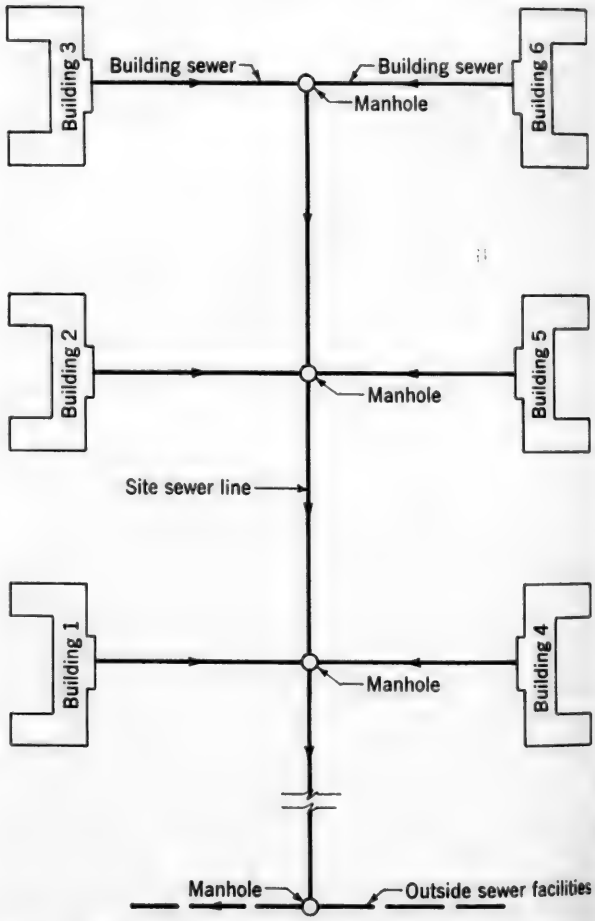


Fig. 1. Typical arrangement of sewer piping that serves a group of apartment houses.

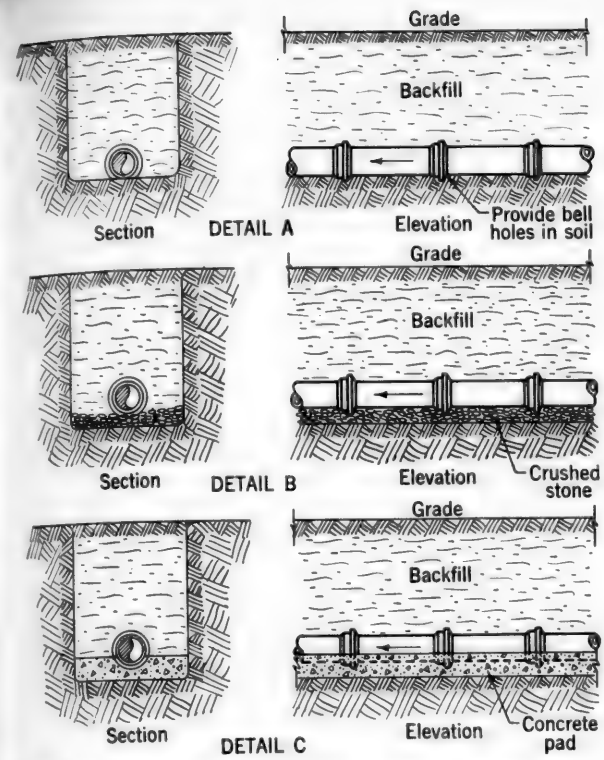


Fig. 2. Various methods of installing piping at the bottom of a trench.

Detail *B* shows how the piping can be installed in trenches that have been dug deeper than required or are not uniform in depth or grading. In this case, crushed stone is added to the trench bottom and is carefully graded for the proper support of the piping. The crushed stone offers a firm bed for pipe support and is also of value when muddy conditions are encountered at the trench bottom.

Detail *C* illustrates how concrete can be added to the trench bottom for a firm piping support. When required, reinforcing rods are set in the concrete. Also when necessary, the piping is completely encased in concrete to satisfy installation requirements.

Fill

Very often, by virtue of the contours of the site, fill is needed in the depressed areas to grade the site to the desired level or slope. Grading procedure is accomplished so quickly today that fill will not have sufficient time to compact. Unless fill is compacted, it cannot support the weight of piping. Figure 3 shows the piping installed in a section of the site where a depressed point in the grading was filled in.

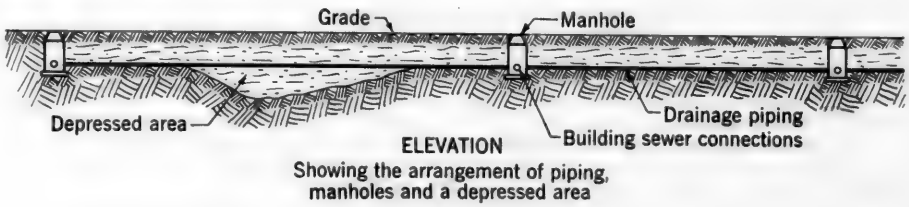
Fill requires a number of months to fully compact in a natural way. Since fill placed in this depression does not have sufficient time to compact, it cannot be relied upon to support the piping installed as shown. Unless adequate means are considered for the support of the piping it can sag and rupture. It is needless to mention, the health hazard that will result when a line conveying the sanitary waste of the buildings ruptures. Furthermore, a heavy rainfall could cause a washout at the point of rupture.

Piping Supports

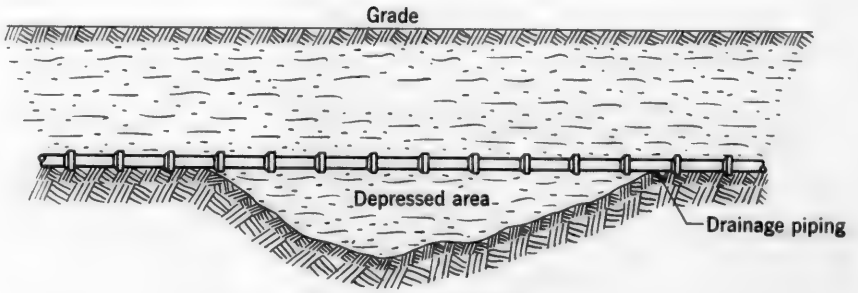
When piping is to be supported in fill, there are a number of different methods that may be utilized to support the piping, and two methods that may be used with a good deal of success are shown in Fig. 4.

Method 1 of Fig. 4 shows how piling may be driven down into the earth for stable footing to support the piping. Brackets are placed on top of the piling to serve as a cradle for the piping. The piling is usually of selected timber and is treated to best withstand the particular type of soil in which it is placed. This method has certain limitations and when larger diameter piping is to be supported, more substantial methods must be considered.

Method 2 shows how large diameter piping can be supported. Note that with this plan the piling is driven down into hard pan for adequate footing. A cross member is placed across the top of the piling on top of which



ELEVATION
Showing the arrangement of piping, manholes and a depressed area



ENLARGED ELEVATION
Showing the potential danger to piping installed in fill

Fig. 3. How depressed areas or voids can affect the installation of underground drainage piping.

timber planking is placed to actually support the piping for the length of the depression into which fill has been placed. Wood cleats are nailed to the planking to afford proper alignment for the piping. Timber used in this arrangement is of selected stock and must be treated to withstand the soil action. For both methods, the piling must be spaced in accordance with the weight of the piping. When either method is carefully applied, the danger of line settlement will be completely removed. Piping shown in Method 1 and 2 of Fig. 4 is for example only and the same methods of support may be used for any of the piping materials that are listed earlier in this article.

Marshy Ground

Sometimes it becomes necessary to install piping in marshy or unstable ground. When this problem arises, it can be overcome in a number of ways and one suggested method is shown in Fig. 5.

Here the trench is dug and a cradle of crushed stone is provided at the trench bottom to support the piping. This means of support is accomplished in the following manner. A framework of planking is installed at the trench bottom and is spaced and held together with tie rods. The planking, of course, is sloped to conform to the designed slope required for the piping. The space between the planking is filled with crushed stone for the actual support of the piping. This means will provide a very suitable method of support in the marshy ground. Other methods may be employed with equal success. Sometimes timbers are placed like railroad ties to support the piping.

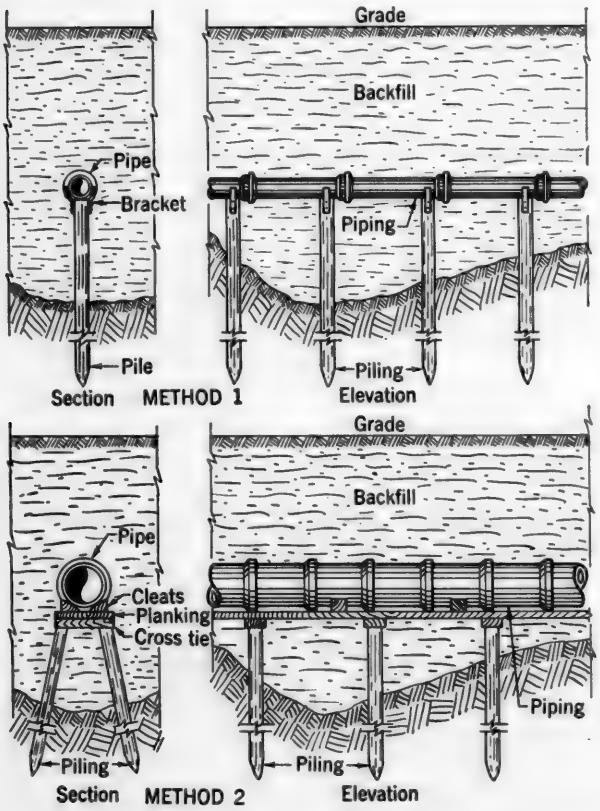
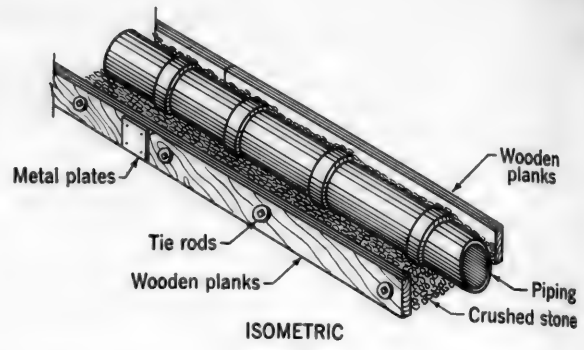


Fig. 4. Methods of supporting piping in fill.



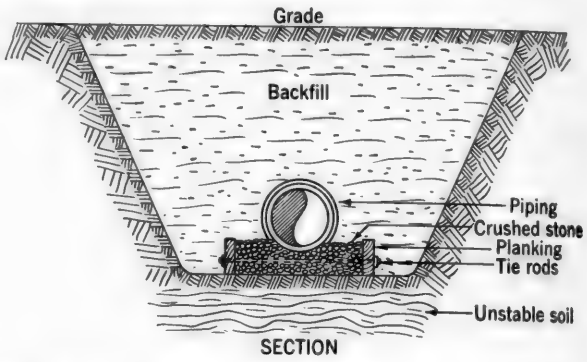


Fig. 5. An arrangement for supporting piping in unstable soil. There are other methods.

When piping is to be installed in wet, unstable ground it is often necessary to use well points and pumping equipment to keep the trench drained of water while the supporting methods are set in place.

Shape of Trenching

The particular shape of a trench to be dug depends upon the type of soil in which the digging is made. Three different trench shapes are shown in cross section in Fig. 6.

The first is a narrow trench with vertical sides that can only be dug in hard clay.

The second method shows how the trench sides are sloped when the trench is to be dug in a soil mixture other than hard compacted clay. A two to one ratio is generally used for determining the slope of the sides. However, the excavating contractor will utilize a slope that he decides best fits the job conditions. This procedure is necessary to prevent the sides of the trench from caving in and endangering the workman.

The last method shows a trench with sloping sides that were offset to prevent the sides from caving in. This method is needed where a high percentage of sand is present in the soil.

If space is a factor and a narrow trench is to be dug in sandy soil, then it becomes necessary to erect siding of wood construction to prevent the sides of the trench from caving in. Every precaution utilized in trench digging will pay dividends in that the lives of the workmen are safeguarded.

Backfill

The careful placement of backfill is a very important step in the proper installation of underground drainage

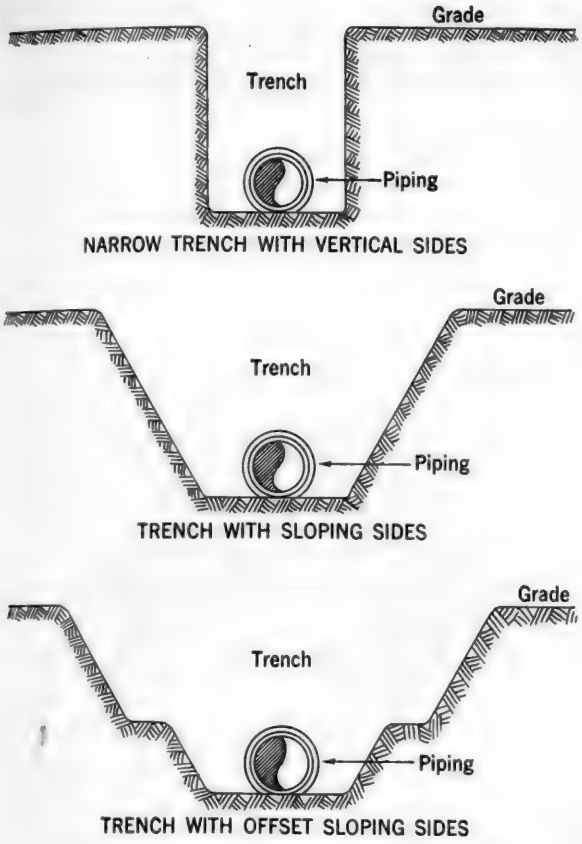


Fig. 6. Types of trenches; use is dependent upon soil conditions.

lines. Backfill placed around the piping itself should be carefully selected and screened to eliminate any large objects as rocks and twigs. All the backfill immediately surrounding the piping should be handled with care and carefully tamped to insure that the piping is properly supported. Water is often used to aid soil compacting but when water is used, it should be applied in measured amounts to avoid the saturation of the backfill around the piping.

The remainder of the trench should then be filled in, with care exercised that large rocks or other heavy objects are screened out of the backfill. When the backfill is replaced in a careful manner, the piping certainly will benefit from the added support the soil affords.

Engineer's Responsibility

Even though soil bearings can be taken along the prescribed route of a drainage line, the engineer can never be sure of just what the excavator will encounter as he digs the trench. Therefore, the engineer must include in his specifications, the instructions that this contractor will furnish and erect the adequate supports needed when the piping is installed in unstable soil. The specifications should also include the instructions that the piping be carefully sloped as per the calculated pitch to assure that the system will perform in the manner for which it was designed. Many specifications include a section that requests that the contractor present for approval, the method of supporting the piping that he proposes to use in the event that unstable soil conditions are encountered. There are a number of ways that this matter can be handled.

Each project must be judged on its own merits. The local plumbing, sewer and highway departments can be of considerable help in this regard when they are consulted for their advice because of their knowledge on the manner in which similar installations were handled in the area. Manufacturers of the piping material used can certainly offer many helpful suggestions.

Lubrication Important for Centrifugal Compressors

When dealing with high rpm such as are used in centrifugal compressors, the design and operation of the lubrication system are extremely important. Bearing specialists agree that 90% of bearing wear occurs during the accelerating period when lubrication is inadequate. It is therefore important that the compressor have adequate lubrication not only during operation, but before startup.

There are several methods of providing preliminary lubrication to the compressor bearings, according to engineers of The Trane Co. These are:

1. An oil pump arrangement whereby the driving power is provided by the compressor shaft. With this type of lubrication system, the compressor must be operating before the oil pump starts. The only lubrication during the initial startup is that which is made possible by oil rings provided with each shaft bearing.

2. An arrangement which utilizes a shaft-operated gear pump and hand-operated auxiliary pump. The auxiliary pump is used to provide lubrication to the bearings before the startup. This means that operation cannot be entirely unattended.

3. A system whereby there are two oil pumps. One of these is motor driven and the second, driven from the compressor shaft. The motor-driven pump is started prior to the compressor startup. The auxiliary motor-driven pump continues to operate until the delivery pressure from the shaft pump is greater.

4. A lubrication system wherein controls are interlocked so that the separate motor-driven oil pump must start, operate, and provide a predetermined oil pressure before the compressor starts. This system permits safe, automatic operation.

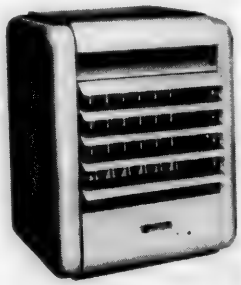
Regardless of the method of lubrication used, any failure of the oil pressure must shut down the unit. The lubrication system should also provide enough oil in its oil lines to enable the compressor to coast safely to a stop should an oil pressure failure take place.

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on the last page for securing additional information about new equipment and materials described in this department.

Gas-Fired Unit Heater

John J. Nesbitt, Inc., Philadelphia, Pa., announces Series K gas-fired unit heater, a redesigned unit said to provide efficient, automatically controlled gas heating at low costs for factory, showrooms, garages, warehouses and other commercial or industrial installations.



Unit heater is lighter in weight throughout the ten models ranging from 25,000 to 250,000 Btu per hr. For example, the 35,000 Btu unit weighs only 66 lb. Design eliminates bulk, which in turn saves head room and working space. Maintenance is reduced to a minimum; controls are located at the outside rear of the unit for easy access. The motors in all size units are directly connected to the propeller fan and there are no internal starting switches to get out of order, the company reports.

Units are sound rated according to the AMCA Code, and have been fully tested and approved for use with all gases by the American Gas Association and all utilities and municipalities requiring supplementary approval.

More information? Circle Item 1, postcard, last page.

General Ventilation Fans

A belt drive fan, designed for maximum air delivery at extremely low noise levels, is announced by Power Line Fan Co., Plainfield, N.J. Named Type BV, these efficient fans are planned for general ventilation of factories, schools, churches, and institutions where static pressure does not exceed .111 to .125 inches w.g.

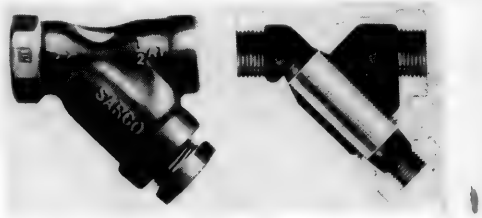
Special features of the fan include all-steel welded construction throughout, streamlined venturi orifice, precision-balanced blades, low power consumption, and minimum maintenance. Quiet, economical operation is reported by the company through the low-speed V-belt drive, and the one-piece orifice panel and welded construction is designed for lasting strength. Fans have PFMA-certified ratings.

More information? Circle Item 2, postcard, last page.

Self-Cleaning Pipeline Strainer

A new line of semi-steel, self-cleaning pipeline strainers in sizes from ¼ through 3 inches is announced by Sarco Company, Inc., New York, N. Y.

Features of this strainer, Type AT, include high



strength construction of the semi-steel (ASTM-A48-48, class 30) body internal design that insures tight fit of the screen cylinder without buckling; perforated, heavy gage screen with spot welded lap seams for maximum rigidity with smooth inner surfaces; and built-in sediment collection chamber integral with cap. The 45 degree design facilitates clearing by blow-off.

Every strainer is hydrostatically tested, and is rated for saturated steam or liquids to 250 psi, and 475 deg F total temperature.

More information? Circle Item 3, postcard, last page.

T-P Relief Valves

Watts Regulator Co., Lawrence, Mass., announces two new ASME-rated, self-closing temperature and pressure relief valves. Designated No. 141S and No. 141X, both have male inlet and ¾-inch female outlet connections. No. 141S is equipped with lever and short thermostat while No. 141X is equipped with lever and extension thermostat. Both valves are of all-bronze construction and have a steam pressure discharge rating of 1,028,000 Btu per hr at 125 lb setting and AGA temperature water rating of 750,000 Btu per hr.

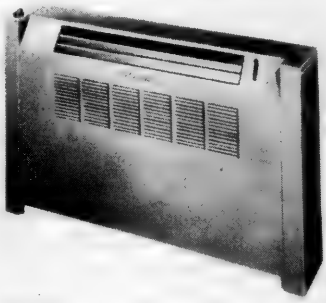
According to the manufacturer, the new Series 141, in addition to the ASME-rated Series 40-N40-140-240, affords a most complete range of sizes, connection styles, and ratings in order to facilitate almost any installation requirement.

More information? Circle Item 4, postcard, last page.

Year-round Wall Unit

A through-the-wall room air conditioning unit that provides economical year-round comfort is introduced by Modine Manufacturing Co., Racine, Wis. All the advantages of centralized heating and decentralized cooling are integrated in the company's self-contained Airditioner air conditioning unit. It can be used, equally well, for both remodeling and new construction.

Unit incorporates steam or hot water heating with a self-contained compressor and cooling coil circuit, with



air-cooled condenser. Each room unit is individually controlled by the tenant. No duct work, cooling tower drain lines, or piping insulation is required. Installation costs for such systems have been reduced by as much as 50%, the company reports. All functions of a complete comfort conditioning system are incorporated: forced-air heating, cooling, filtering, dehumidifying and exhausting of stale room air.

Measuring 38 inches long, 18⅜ deep, and 22½ high, the unit has a room enclosure only 7 inches deep which may be recessed as much as 3⅛ inches. Unit can be installed so it will not protrude beyond the exterior wall face to mar architectural lines. It is rated at 8700 Btu per hr cooling capacity, 15,000 Btu per hr heating on 2-lb steam, or 13,100 Btu per hr on 180-deg hot water.

More information? Circle Item 5, postcard, last page.

Pillow Block

Introduced by The Fafnir Bearing Co., New Britain, Conn., standard series LAKH pillow block ball bearing,

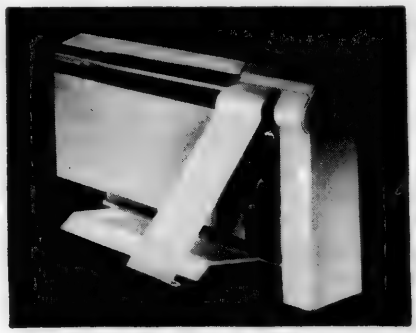
illustrated, has been designed to meet specific customer requirements for varying over-all dimensions.

Similar in design and load capacities to other of the company's standard series pillow blocks, this series features a wide inner ring ball bearing incorporating the company's Mechani-Seal. Said to be frictionless and wearless, the seal is an integral part of the bearing which keeps lubricants in and foreign matter out. The new units are self-aligning in any direction and can be installed immediately.

More information? Circle Item 6, postcard, last page.

Baseboard Radiation Accessories

A functional concept in design, piano-hinged accessories is the latest field-tested addition to the line of baseboard radiation manufactured by Slant/Fin Radiator Corp., Richmond Hill, N. Y. Described as a radical departure from the older screw-on type, the new acces-



sories, which include wall trims, end caps, valve enclosures, and inside corners, are also designed to snap into place.

These hinged accessories allow the installer to complete his accessory installation immediately without having to wait until plaster or sheet rock is mounted. Previously, air vents or control valves were accessible only when valve enclosures were used, or when the entire front panel was removed. This often resulted in damage to the finished coat of paint. Now the front portion of the accessory can be lifted, and the contractor has easy access to the valves or vents.

More information? Circle Item 7, postcard, last page.

Horizontal Gas-Fired Boilers

Federal Boiler Co., of Midland Park, N. J., announces a line of gas-fired horizontal steel boilers, designated Series FDG. Boiler is fired by an atmospheric-type gas burner. Built-in tankless coils assure a full supply of domestic hot water, eliminating the need for a separate water heater.

The manufacturer claims that the FDG is the only gas-fired horizontal unit that can be also converted and operated equally as well with oil burning apparatus should future conditions demand such a change.

Boilers, which are recommended by the manufacturer for commercial and multiple dwelling work, are offered in sizes from 1500 to 3000 sq ft steam, unjacketed or jacketed, and can be job-built by trained factory crews in metropolitan areas.

More information? Circle Item 8, postcard, last page.

New Open Motor Line

Application of silicone rubber and epoxy resins to motor insulations has enabled Allis-Chalmers Mfg. Co., Milwaukee, Wis., to announce its Super-Seal line of a-c open motors for use in those fields once dominated by totally enclosed, fan-cooled, and weather protected motors. At present, the line extends from one hp, at 220 v, to 55 hp, at 4160 v.

Photo shows one of the open motors, with epoxy-encapsulated stator, at full rpm, immersed in a tank of water. Insulation resistance, the company states, is reduced very slightly after long periods of immersion, but not to the point of electrical breakdown.

Because of the ability of epoxy resins and silicone rubber to withstand moisture, as well as abrasive dusts, many applications are cited by the company where motors in the new line may be substituted, at savings to 60%, for the more expensive totally enclosed motors.

More information? Circle Item 9, postcard, last page.

Air-cooled Commercial Units

A line of air-cooled commercial air conditioning units rated up to 254,000 Btu per hr gross cooling capacity is available from American Blower Division of American-Standard, Detroit, Mich. Introduced with the units is an original concept of matched performance ratings using oversize condensers to provide in the new line the greatest size range selection in the industry, according to the company.

Each base unit in the line is rated not only with condensers of matching size, but with oversize condensers as well. The effect is an expansion from 6 to 12 in the number of capacities available. The 12 capacities can be obtained by using just 6 base units with selected quantities from 3 available condenser sizes. This minimizes the distributor and dealer inventory problems while permitting more accurate selection of the specific capacity to fit a given need. The latter advantage produces economies for the purchaser both in initial cost and in operating costs as well; no longer need the user pay an excessive penalty for the next larger size where cooling requirements fall between capacities of matched units.

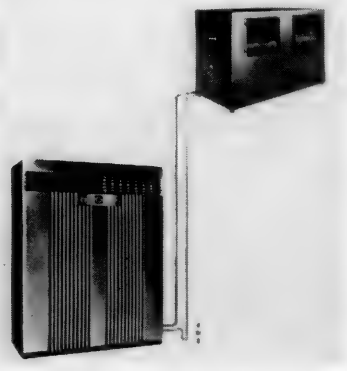


Photo illustrates a typical combination of units. Bend in pipe marked with an asterisk is refrigerant trap in discharge line.

More information? Circle Item 10, postcard, last page.

Heavy Duty Thermostat

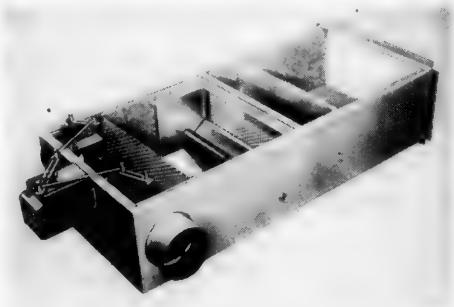
A heavy duty, line voltage room thermostat with increased non-inductive ratings for electric heating applications is announced by Penn Controls, Inc., Goshen, Ind.

Designated Type 876, the thermostat is used for control of unit heater and industrial space heating equipment. Thermostats are supplied with a standard range of 40 to 80 deg F, and adjustable differential from 2 to 7½ deg.

More information? Circle Item 11, postcard, last page.

Double Duct Mixing Unit

A double duct mixing unit with a self-contained constant volume control is available from Barber-Colman Co., Rockford, Ill. Stabilization of double duct systems is simplified with this unit which delivers constant volume while mixing hot and cold high velocity air, and reducing it to conventional velocities at a minimum noise level. Since it is available in octopus, open end, and integral diffuser types, it can serve one or a series of diffusers.



Temperature control and volume regulation are treated as separate functions; operation of one cannot adversely affect the other.

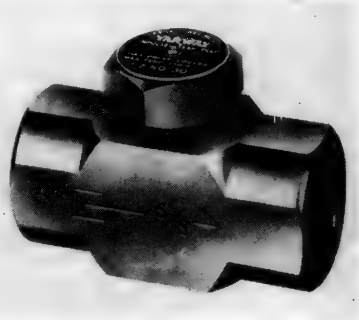
Simple and effective self-operated constant volume regulating valve requires no power source or motor operator. It maintains constant volume delivery with ± 5% for hot and cold inlet air pressure differences as high as 5:1. A single manual adjustment permits dialing of volume required.

Hot and cold inlet control valves can be either electrically or pneumatically operated, with the single motor mounted inside or outside of the unit. Air mixture is held uniform within 1 deg F for each 10-deg difference between hot and cold supply air.

More information? Circle Item 12, postcard, last page.

Impulse Steam Trap

A new impulse steam trap, engineered especially for light condensate load applications, is announced by Yarnall-Waring Co., Philadelphia, Pa. Design of the steam trap, Yarway No. 30, permits exceptional economy



of operation and maintenance at light loads, the company reports.

The lever-type valve, which pivots about a fulcrum, discharges air and condensate at full capacity at start-up time and snaps shut when steam reaches the trap, providing closer shut-off. Lever action also provides much quieter operation.

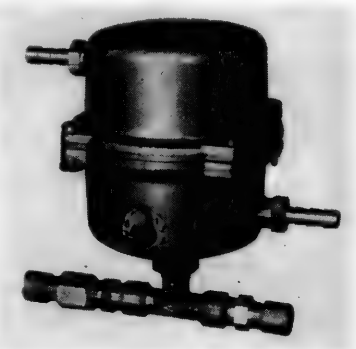
Trap is suited for used on steam tracer lines, steam main drips, small platens, and other applications with light condensate loads. Trap is available in ½-inch size only, for operating pressures from 8 to 600 psig.

More information? Circle Item 13, postcard, last page.

Static Pressure Regulator

Individual room control of air volume in office buildings, hotels, clubs, hospitals, and restaurants is provided by a static pressure regulator announced by The Powers Regulator Co., Skokie, Ill. Called the Constant Air Volume (CAV) regulator, unit is installed on ceiling or window mixing boxes in high-velocity air conditioning system. It automatically maintains a constant air delivery from the mixing box regardless of changes in the hot or cold air supply.

Regulator is linked to pneumatic motors which open



or close damper valves admitting the hot and cold air to the mixing box. The hot air damper is also actuated by a room thermostat. An adjustment on the regulator enables mixing box to provide different air flows to meet changing conditions. If a room originally used as a one-man office now accommodates two or three, the air flow can be easily increased without affecting other rooms in the building.

Company points out that the regulator makes it simple to balance a high velocity system. With thermostats and dampers alone, it may take months to balance the air conditioning in a building, since a change made in one room affects the others. With the CAV regulator, once a room's volume requirements are provided, no further adjustment is necessary.

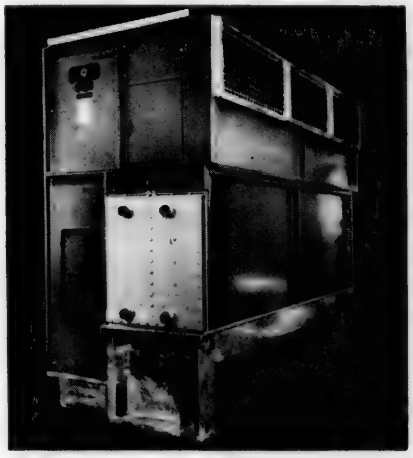
Regulator operates on a 15 psi air supply, and will respond to as little as .005-inch water gage. Maximum ambient temperature is 140 deg F.

More information? Circle Item 14, postcard, last page.

Liquid and Gas Cooler

Series 44-H00, a new model Aero heat exchanger for liquid and gas cooling in industrial process applications is announced by Niagara Blower Co., New York, N. Y. Evaporation of a water spray over the cooling coils provides the cooling effect at the rate of about 1000 Btu per lb water evaporated.

The air stream, in which the heat is rejected, enters the unit near the top of one side, travels downward



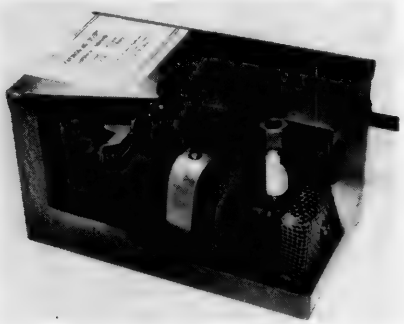
through the spray chamber and is drawn upward through the plenum and discharged by propeller fans. The fluid is cooled to a point close to the atmospheric wet-bulb temperature and the control of temperature is completely automatic, governed by modulating the amount of air flow of fresh or recirculated air. Heat is removed at the rate of in-put.

Special features include completely cleanable coils and *winter-summer* dampers that permit outdoor installation in severe climates with no danger of freezing damage. The cleanable coil is provided with an easily removable header and a crane to support it while the cleaning is being done, said to greatly shorten the job and save much labor. Further, the company states, construction of the unit in removable panel sections assures the most reliable maintenance and saves much in transportation expense and erection. A range of sizes is available providing capacities up to 18,000,000 Btu per hr under standard conditions.

More information? Circle Item 15, postcard, last page.

Compact Condensate Unit

A low profile condensate unit is announced by Little Giant Pump Co., Oklahoma City, Okla. This small-sized unit measures 4½ inches wide by 4½ high and 8½ long, and has been designed for today's compact air conditioning equipment.



Unit consists of a hermetically sealed recirculating pump installed in a sturdy metal corrosion-resistant condensate tank. Complete controls include a positive displacement switch with float controls, circuit breaker, and three-conductor cord for electrical grounding.

Completely automatic in operation, condensate unit is available for 115 volt, 60 cycle or 220 volt, single-phase current. Ease of installation, quiet operation, and neat appearance are features of the unit, which can also be used as an automatic sump pump by piercing a hole in the tank bottom.

More information? Circle Item 16, postcard, last page.

Four Airfoil Units Added

Four centrifugal fan sizes, designed to cut objectionable fan noise to a minimum, are added to the line of BC airfoil centrifugal fans offered by Ilg Electric Ventilating Co., Chicago, Ill. The new models are larger and increase the maximum capacity range in the line up to 55,152 cfm. All four units are available in direct-connected and belted models.

Company engineers state that the company's airfoil blade design used in its centrifugal fans greatly reduces the eddy currents and turbulence responsible for most objectionable fan noise. The airfoil-type blades are also said to be less subject to drag and shock losses than fan blades of uniform thickness, enabling the fan to move more air more quietly while operating at the same speed as the ordinary centrifugal fan, and in many cases permitting the use of smaller airfoil units to do a specified air-conditioning or ventilating job.

Fans are suitable for all Class I, II, and III operations up to 9 inches static pressure.

Spark- and corrosion-resistant construction has been used throughout the fan line. Wheel, inlet cone, and sides of housing are aluminum, and sheet aluminum is used for the scroll.

More information? Circle Item 17, postcard, last page.

Molded Power Roof Exhauster

A power roof exhauster molded in reinforced Fiberglas is announced by The Gallaher Co., Omaha, Neb. Reported to be the first of its type, the unit will be marketed under the name Super/Air-Van.

Company states that the unit offers architect, engineer and builder advantages not previously available in power roof exhausters. These include inherent quietness since power roof exhauster is constructed of a sound absorbing and dampening material; structural strength equal to steel, and greater impact strength than either aluminum or steel; light weight which means new economy in both shipping and installation costs; and corrosion resistance.

Units never need painting; color saturated material is permanent.

More information? Circle Item 18, postcard, last page.

Mat-Faced Duct Insulation

A mat-faced Fiberglas flexible duct liner for internal application on all rectangular and round, cold and hot, air conditioning metal ducts is announced by Owens-Corning Fiberglas Corp., Toledo, Ohio. Said to combine outstanding thermal and acoustical properties, the insulation has a maximum air friction coefficient of 0.020 when adhered inside a finished duct. It is fire-resistant and meets NFPA and NBFU standards.

Low resistance to moving air, the company states, is made possible by a smooth glass mat face that is firmly bonded to the insulation by a process that makes the surface and the insulation one. Air velocities to 4,000 fpm may be used. Thermal conductivity of 0.24 at 75 deg F is said to ensure high insulating efficiency. Noise reduction coefficient is 0.70 to 0.80 in 1-inch thickness, No. 6 mounting.

The mat-faced liner is manufactured in ½- and 1-inch thicknesses, in widths of 24, 36, and 48 inches, and roll lengths of 100 ft in ½-inch thickness and 50 ft in 1-inch thickness.

More information? Circle Item 19, postcard, last page.

Fire Relief Unit Redesigned

The Pyrojector, an automatic fire and explosion relief unit, has been redesigned with many significant changes resulting in improved operational characteristics, announces its manufacturer, The Swartwout Co., Cleveland, Ohio.

Most noticeable is the change from curved to flat

dampers, permitting the use of improved insulation. Stronger torsion springs have been added to assure positive opening action even under loads when the fusible link in the triggering mechanism reaches 212 deg F.

An explosive force of 10 lb per sq ft will open the dampers, providing 28 sq ft of free escape area. In fire or explosion emergencies, the unit opens automatically to release heat, smoke and, explosive blasts upward through the roof instead of spreading them outward as a closed roof does. This automatic release greatly reduces plant damage.

More information? Circle Item 20, postcard, last page.

New Type Flowmeter

A flowmeter which provides direct reading of total mass flow, independent of temperature and pressure variations, is announced by Hastings-Raydist, Inc., Hampton, Va. It is calibrated in milligrams of air per minute and is available in several flow ranges. It is said to be especially suited for measuring low rates of flow.

A heated thermopile element in a flow tube has a self-compensating circuit for both ambient temperature and

rate of change of temperature. It is installed directly in the flow line or, in large lines, can be placed in a bypass. Pitotstatic tubes or orifice plates record flow as a function of the square of velocity and gas density, the company points out, while this instrument avoids the problem of corrections by recording mass flow directly.

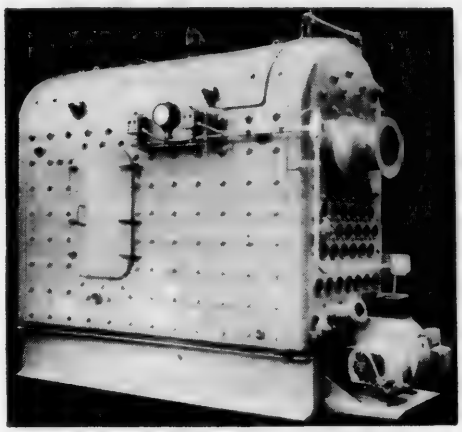
Models are furnished in sloping front indicator case, as shown, or are available for panel mounting. They are suitable for use with control and alarm devices and self-balancing type recording flowmeters.

More information? Circle Item 21, postcard, last page.

Water Tube Package Boilers

A line of Compak forced draft water tube package boilers is announced by The International Boiler Works Co., East Stroudsburg, Pa.

These fully automatic oil-gas fired boilers have a forced draft burner which eliminates the need for elaborate controls, a stack, or an induced draft fan, the company states. Water tube construction coupled with multi-pass design is said to assure rapid steam or hot water generation, and guaranteed 81% thermal efficiency.



Full access is provided to both fireside and waterside of all tubes without dismantling the boiler. The sweeping action of hot gases over the outer surface of the water tubes makes the boiler virtually self-cleaning. Large furnace volume provides a primary or radiant heating surface more than twice as great as found in modified Scotch firetube boilers, according to the manufacturer.

Boilers are available for low or high pressure hot water or steam generation in capacities to 100 hp. Sizes to 600 hp will be announced soon.

More information? Circle Item 22, postcard, last page.

Neck, Flange Centerlined

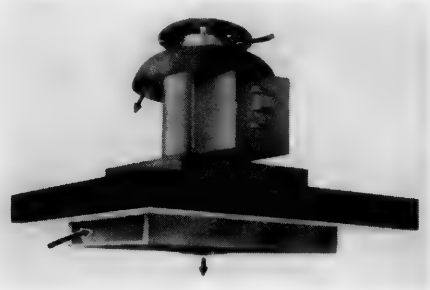
By a process exclusive with the company, OTM Corporation, Houston, Tex., delivers to each fabricator its welding neck and slip-on flanges already centerlined, and at no extra cost.

To centerline a flange by hand, the company points out, means spending 15 to 20 minutes on each flange at the fabricator's location. Receipt of flanges and necks precenterlined by means of a machine developed and patented by the company will mean savings in labor time and production money to fabricators, it is said.

More information? Circle Item 23, postcard, last page.

Ventilator Exhausts and Supplies

A ventilator capable of simultaneously exhausting and supplying air is manufactured by Canada Fans Limited, Montreal, Que. V-belt driven, the Dual-Aire ventilator will supply up to 70% of fresh outside air in relation to that exhausted from a building. The balance, company states, can be made up through natural infiltration.



For buildings with a high ceiling, the diffuser is designed to supply fresh air in a vertically downward discharge, spreading into a large cone with very low velocity as it reaches the floor area. For low-ceiling buildings, diffuser can discharge fresh air along the ceiling horizontally and then down the walls. Movement of air in this manner is said to eliminate condensation and draft in the center of a room.

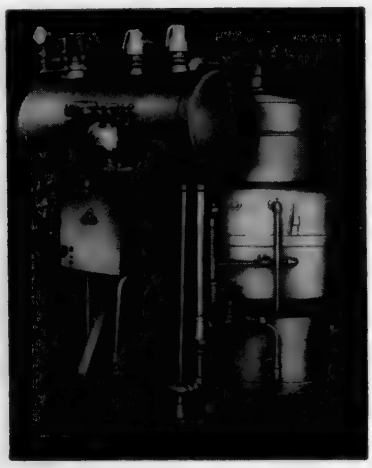
Pre-heating or cooling of outside air is possible by addition of heating element or coils. Unit can be wall mounted as well as roof mounted.

More information? Circle Item 24, postcard, last page.

Water Tube Boilers

A line of water tube boilers, called the Vapor Drum Modulatic, is announced by Vapor Heating Corp., Chicago, Ill. Its heating surface is designed for maximum output in minimum space.

Weight of the boilers is such that only 100 to 175 lb per sq ft of support is required. The boiler can be installed on any flooring that will support an average man.



Units are completely automatic, explosion-proof, and require no chimney for forced draft—merely an outlet for gases.

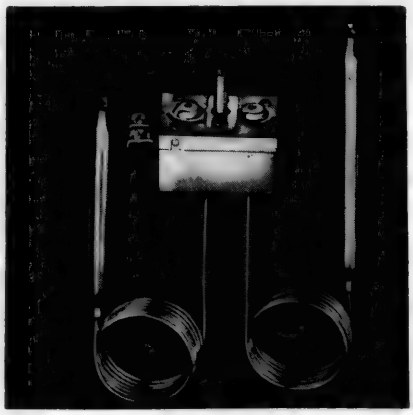
The 150-hp model shown occupies a floor space of 41.3 sq ft and is 7 ft 3 in. high. Only 2 ft of surrounding space is necessary for servicing. No special flooring is required since the 7000-lb weight is distributed at less than 175 lb per sq ft.

Boilers are available in a range of sizes from 20 through 75 hp, 100 hp, and 125 to 150 hp. They can be furnished to deliver low pressure steam at 0 to 15 psi, or in a high pressure line, supplying 5 to 150 psi. The smaller units will burn No. 2 fuel oil or low pressure gas. The 100-hp and larger models can burn No. 5 fuel oil as well.

More information? Circle Item 25, postcard, last page.

Effective Temperature Control

Its Effective Temperature Control, Model G2-E, a thermostat that reacts both to temperature and humidity, is announced by The Wilcolator Co., Elizabeth, N. J. Air conditioners equipped with the twin-bulb device respond to both temperature and humidity changes and compensate by providing more cooling on humid days and less on dry, the company states.



The control is equipped with both a wet and dry bulb which combine their signals so that the thermostat controls at any selected Effective Temperature. The wet bulb is cooled by means of a wicklike sleeve which is kept moist by condensate from the evaporator. With a rise in wet-bulb temperature the control temperature is reset to compensate for humidity changes.

More information? Circle Item 26, postcard, last page.

Registers and Grilles Added

Universal Diffuser Corp., Tuckahoe, N. Y., announces the addition of a complete line of air conditioning registers, grilles, and accessories to its extensive line of air diffusers.

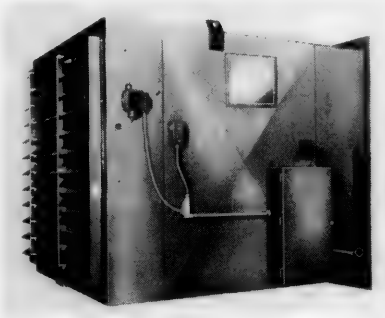
The grille faces are made of 18 gage steel with roll-formed streamflow blades. The opposed blade damper has perfectly overlapping blades which prevent air leakage when shut. All guides and holes are made to fine tolerances, and blades are so evenly balanced that the opposed blade damper can truly be called a silent damper, the company reports.

More information? Circle Item 27, postcard, last page.

Gas-Fired Air Make-Up Unit

A gas-fired air make-up unit is offered by Aerovent Fan Co., Inc., Piqua, Ohio.

Designed to temper and filter outside air entering ventilated areas, units operate with natural, mixed, manufactured and propane gas. By supplying sufficient volumes of clean, pre-heated air to replace exhausted air, negative pressures and infiltration of cold air are eliminated. Thus, fans and heating systems operate at normal design capacity for greater efficiency and economy, the company reports. Result is better pressure balance with more uniform temperatures in all factory areas.

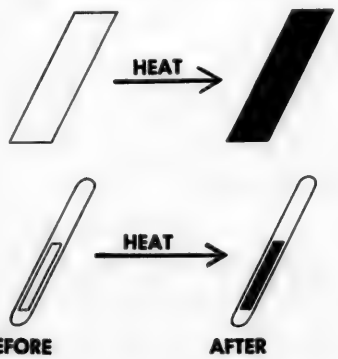


Available in four unit arrangements in four sizes from 36 to 54 inches for various capacities, Btu ratings, and pressure conditions, unit is a self-contained package designed for easy installation. Only fuel and electrical connections need be made to place the unit in operation.

More information? Circle Item 28, postcard, last page.

Paper Thermometers

Thermopaper and Thermotube, illustrated schematically, top and bottom, disposable paper temperature indicators, are now available for 100, 105 and 110 deg F to supplement the previously offered range of 115 through 490 deg. These indicators, a product of Paper Thermometer Co., Natick, Mass., measure temperatures by exhibiting an irreversible color change when subjected to predetermined temperatures. Speed of response is said to be less than 1/10 sec and accuracy, 1%.

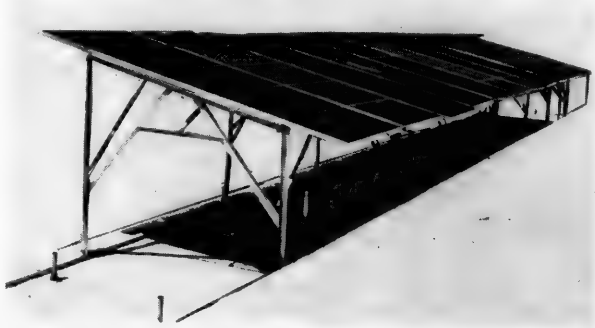


Indicators are widely used for checking maximum temperatures around heating equipment, electric motors and other areas in which potential fire hazards exist, the company states. It is necessary to know these peak temperatures for installation of the proper fire-detecting thermostats and sprinkler systems. A brochure detailing uses, temperatures, and prices is available.

More information? Circle Item 29, postcard, last page.

Natural Convection Condenser

A condenser that uses the natural convection of air is announced by Edwards Engineering Corp., Pompton Plains, N. J. It is available in 2, 3, 5, and 7½ ton units that may be used in multiples to achieve any tonnage desired.



Advantage is said to be the relatively light weight per ton of air conditioning and hence elimination of any special support or shoring problems. Further, the company states, units may be designed into the architecture of the building. The finned tube units are mounted horizontally or at an angle to the building, as illustrated, creating a single horizontal surface. Tonnage ratings are based on a temperature difference of between 25 and 30 deg F between condensing and ambient air temperatures.

More information? Circle Item 30, postcard, last page.

Plastic Spray Nozzles

Spray nozzles for cooling towers, air washers, and similar equipment, made of Eastman Tenite butyrate plastic, are being produced by Texas Plastics Products Co., Houston, Texas. Advantages claimed for the nozzle include an exceptionally smooth inner surface in the form of an involute curve, and which gives a highly effective break up of water at exceptionally low pressures.

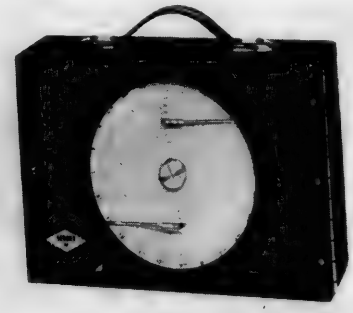
The nozzles have standard screw threads for complete interchangeability. Use of the plastic eliminates the possibility of galvanic action between the nozzle and piping.

Effective atomization is reported at pressures as low as ¼ to ½ psi. The nozzles are offered in 7 models with spray angles from 60 to 100 degrees.

More information? Circle Item 31, postcard, last page.

Humidity, Temperature Recorders

A line of low-priced recording Hygrographs, Thermographs, and Hygrothermographs is introduced by Serdex, Inc., Boston, Mass. Designed for plant rather than laboratory use, these instruments are sturdily built for long service, and are unconditionally guaranteed to operate accurately and perform satisfactorily for a full year. Instruments have a 6-inch chart for detailed analysis of area conditions.



Hygrograph has the company's animal membrane sensing element, and is accurate within 5% over a 15% to 95% relative humidity range and a 32 to 130 deg F temperature range. Thermograph is accurate within 2% over a range from zero to 100 deg F. Choice of spring-wound or electric drive is offered.

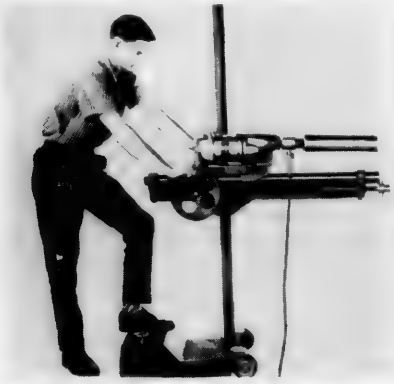
Company offers a plan whereby it is possible to buy one of the units, then at a later date insert the other and pay no more than the price of the Hygrothermograph, which is illustrated.

More information? Circle Item 32, postcard, last page.

Concrete Drilling Machine

A lightweight concrete drilling machine that swivels 360 degrees to allow drilling in any direction is announced by Molco Drilling Machines, Inc., Washington, D. C.

The swivel action of the drill greatly increases its versatility and makes it suitable for use in installing con-



duit, pipe and duct where many of the drilling operations must be performed in confined or hard-to-reach areas. Using thin-wall diamond core bits, this machine will drill holes as large as 6-inch dia. through concrete or any other hard building material at the rate of one inch per minute.

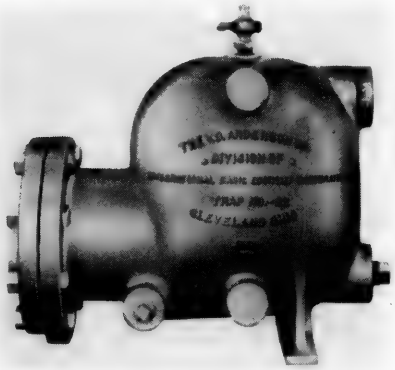
A special kit that will convert core drilling machines which presently drill only horizontally to 360-deg drilling is also available.

More information? Circle Item 33, postcard, last page.

High-Capacity Float Traps

A line of float traps is developed by The V. D. Anderson Co., Div. of International Basic Economy Corp., Cleveland, Ohio, with increased capacities for draining condensate or moisture from steam, air and gas equipment.

These continuous flow type traps are recommended for draining condensate from steam equipment continuously, and automatically, such as ahead of condensate meters where intermittently discharging bucket and thermostatic type traps cause erratic recordings. This continuous flow feature is also desirable for draining moisture from all



types of air and gas purifiers, separators, receivers, tanks and other similar types of equipment, the company states.

Capacities range as high as 32,000 lb water per hr, depending upon the differential pressure. Head and body are made of cast semi-steel, the valve and seat of Anderloy, a corrosion-resistant nickel alloy developed by the company. All other internal parts are made of stainless steel or bronze. The traps are designed for a maximum steam operating pressure of 250 lb.

Furnished with or without a gage glass, traps are manufactured in three sizes. No. 82 trap is tapped ½ or ¾ inch; No. 83 tapped 1 or 1¼ inch; and No. 84 tapped 1½ or 2 inches.

More information? Circle Item 34, postcard, last page.

Thermocouple Assemblies

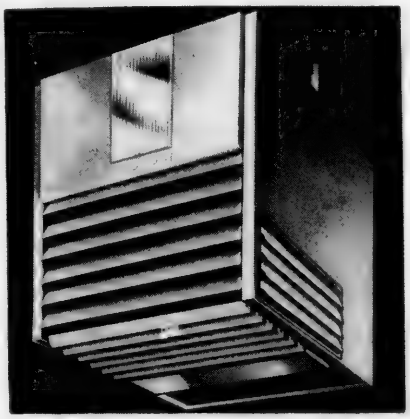
Thermo Electric Co., Inc., Saddle Brook, N. J., now offers an expanded line of industrial thermocouple assemblies. These assemblies consist of standard wire-type and Ceramo thermocouples, connection heads, thermowells, fittings, and mounting attachments. Combinations of these components provide an extremely wide variety of heavy-duty thermocouple assemblies, capable of meeting many industrial requirements.

More information? Circle Item 35, postcard, last page.

Automatic Gas Unit Heater

The Humphrey MD automatic gas unit heater is announced by General Gas Light Co., Kalamazoo, Mich. The fan has been removed from its traditional position, in the back of the unit, and placed on top to blow warm air straight down.

Beneath the fan, a new type of open top heat exchanger consists of a series of self-cleaning sections that are said to provide an exceptionally large area of heat-radiating



surface. Under this heat exchanger is incorporated a battery of enameled steel burners, said to burn all types of gas at maximum efficiency.

Housing of the down-flow heater is of modern, straight-line design, with interchangeable louvers and panels for the front and bottom, with optional louver assemblies for the sides of the cabinet. By installing these louvers and panels in various combinations, the heating engineer can control and direct the flow of warm air frontwards, sideways, or straight down, or any combination of the three directions.

Eleven sizes of units are available, from 60,000 to 270,000 Btu. Battery installations of two, three, or four units utilize same piping, wiring, venting.

More information? Circle Item 36, postcard, last page.

High Pressure Valves

Use of an internal sleeve type construction in its line of diaphragm-operated high pressure valves for hydraulic or cold raw water service, to provide shockless performance and leak-free shut-off with minimum maintenance, is announced by The Sinclair-Collins Valve Co., Akron, Ohio.

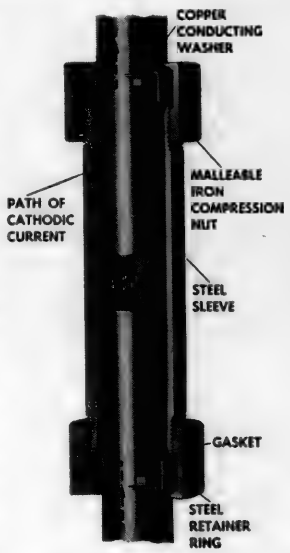
Valve seats are integral in a replaceable hardened stainless steel sleeve. Commercial standard O-rings in molded Teflon back-ups provide a flexible seal between the sleeve and the valve body. According to the manufacturer, positive leakless shut-off is assured, since seating cannot be affected by minute deflections or breathing of the valve body under high pressures. Hydraulic shock or pressure surges in the lines will not cause distortion of the seats with resulting leakage, wire drawing, or cutting, it is claimed, because the O-ring seals compensate for unavoidable body deflections and preserve constant concentricity of seat sleeve and steam. Porting in the seat sleeve is designed to afford negligible flow loss as the stem shifts from seat to seat, thus minimizing loss of inlet pressure to drain. In addition, sleeve design is reputed to prevent leakage commonly encountered in high pressure valves using screwed-in seats, where breathing of the valve body under pressure allows seats to loosen and leak.

Available for 4,000- and 6,000-psi service, in sizes up to 3 inches NPT for 4,000 psi, and up to 2 inches NPT for 6,000 psi, valves are offered 2 or 3-way, normally open or normally closed.

More information? Circle Item 37, postcard, last page.

Electrically-Conductive Coupling

Type 212 electrically-conductive compression coupling has been specifically designed to provide a low-resistance electrical joint essential to cathodic protection systems. This coupling combines all the features of the standard compression coupling manufactured by William E. Pratt Foundry Div., Joslyn Mfg. and Supply Co., Chicago, Ill., and in addition assures a sealed-in bond when the compression nuts are tightened.



Both the standard compression coupling and the electrically-conductive compression coupling are simple to install, are fully reusable, permanently leakproof, and economical. Their design eliminates thread cutting and close fitting of pipe, insures compression seal of gasket without friction or seizure, and produces high compression sealing force at the gasket surfaces.

Both types of couplings are available in sizes from ½ to 2-inch IPS in a variety of metals and gasket materials to meet a wide range of requirements for pipe lines carrying water, oil, gases, or chemicals.

More information? Circle Item 38, postcard, last page.

Versatile Water Cooler

A "wall remote" type drinking water cooler has been added to the line of Temprite Products Corp., Birmingham, Mich. Known as Model WR-5, it is designed for built-in applications within building walls. The cooler can be incorporated into new building designs or may easily be adapted to existing wall fountain installations.

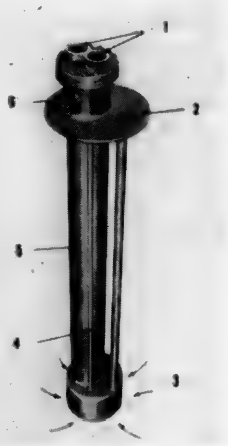
Temperature control is adjustable. Cooling capacity of 5 gph of 50-deg F water will accommodate approximately 60 people hourly in offices, schools, and cafeterias, etc.

An extremely compact 6¾-inch depth makes wall installations practical; width is 23 inches, height is 18⅛ inches.

More information? Circle Item 39, postcard, last page.

Tank Suction Heater

Model VU vertical tank suction heater is announced by Davis Engineering Corp., New York, N. Y. It is designed to simplify inspection and servicing in below-ground storage installations.



Heater is a U-tube suspended vertically into the tank from a support plate resting on a nozzle at the top of the tank. Hot water or heat transfer liquids are used as the heating medium. Applications are to the heating of viscous fluids, such as No. 6 fuel oil, tar, pitch, etc.

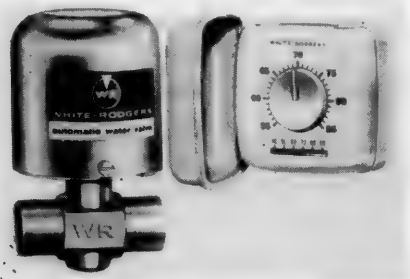
All service connections are outside the tank in an access chamber entered into at ground level. Only the heating tube bundle and its shell lie inside the tank. The top end channel, to which the heating medium circulating lines are connected, can be removed to expose the tube ends and tube sheet for inspection. The entire tube bundle itself can be completely removed without requiring the breaking of any product lines.

Numbers in illustration refer to the following components: (1) heating medium connections; (2) return product connection; (3) mixing chamber; (4) mixing chamber vent line; (5) suction shaft; and (6) product suction connection.

More information? Circle Item 40, postcard, last page.

Zone Control Package

White-Rodgers, St. Louis, Mo., announces a zone control package for hydronic heating which provides multiple zone control using only one circulator and one relay. The company's Fashion thermostat and a small motorized water valve maintain the desired temperature in each zone, eliminating the need for extra circulators, relays



and flow control valves, thus greatly reducing costs. This low-cost system meets FHA requirements for zoning split level homes, and can be applied to existing as well as new installations.

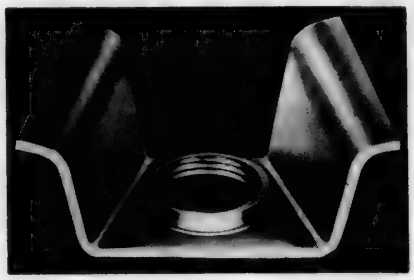
Other benefits are said to result from savings in piping, fittings, wiring and labor, because all zones in the installation use a common return and low voltage wiring.

Also reported by company is the unusually quiet operation of both the valve and the system. Valve is slow opening (45 seconds) which prevents water hammer, and tends to blend the water temperature gradually, thus eliminating expansion noises that so frequently cause complaints.

More information? Circle Item 41, postcard, last page.

Tank Legs

Specially contoured to fit 12-inch and 24-inch diameter standard heads, 10-gage tank legs are announced by Tech Products, Inc., Staten Island, N. Y. According to the manufacturer, they are exceptionally strong and weld



easily to a curved surface.

Legs are manufactured in three standard sizes with either a 7/16-inch hole, or extruded and tapped for 1-inch pipe. Designed to hold tanks a minimum of ¾-inch off the floor, less expensive initial fabrication and installation costs are said to be achieved. A 1-inch pipe inserted in the tapped hole permits raising of the tank to any desired elevation, as well as leveling.

Production samples are available at no charge.

More information? Circle Item 42, postcard, last page.

Temperature-Pressure Relief Valve

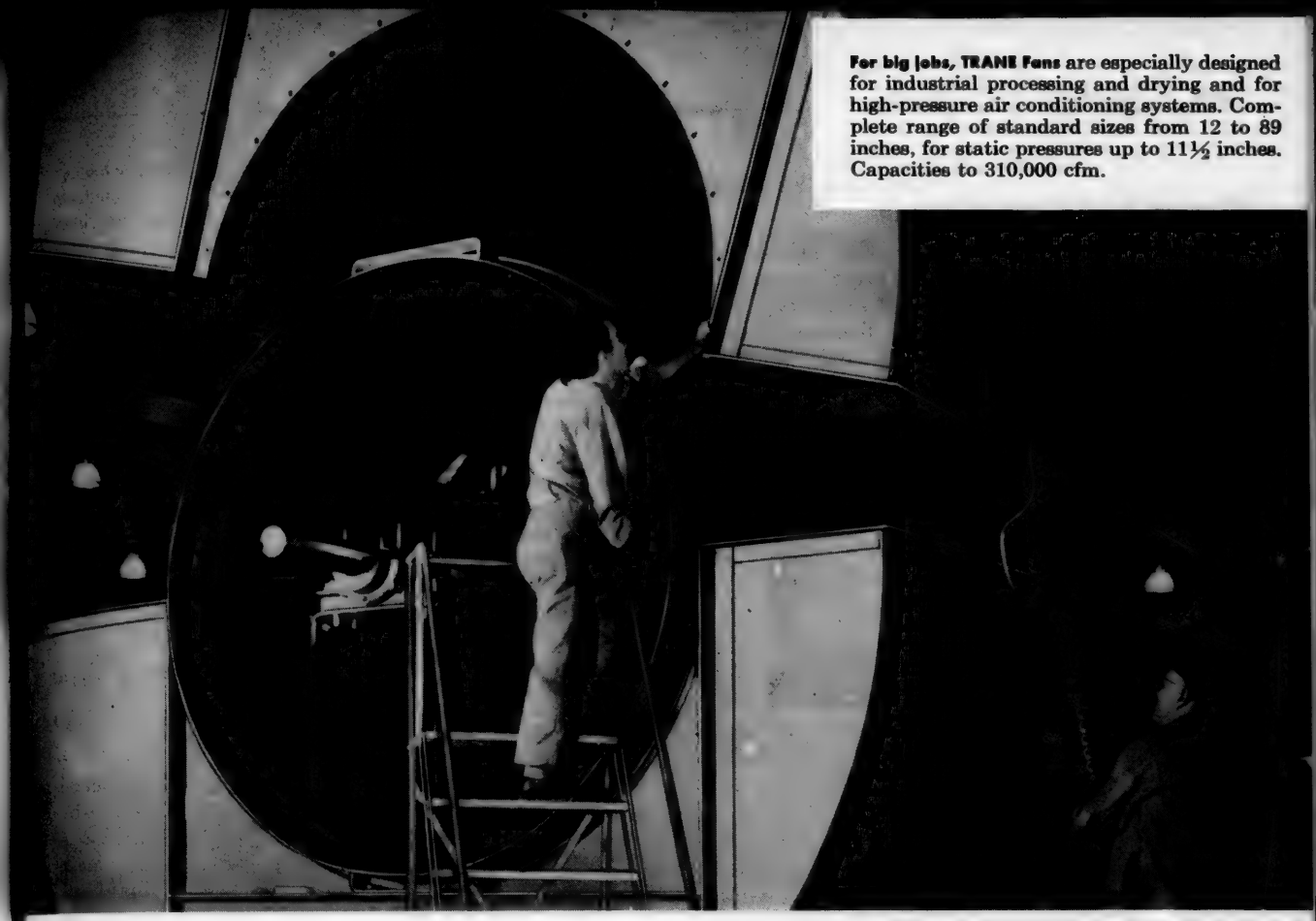
A relief valve for protecting hot water lines against excessive pressures or temperatures is announced by Mansfield Sanitary, Inc., Perrysville, Ohio.

Known as Model No. 494, it is equipped with a fusible plug at the end of a 6-inch extension tube. The latter immerses the plug in the tank's hottest water and offers immediate relief as soon as temperature exceeds 210 deg F. Plug, as well as bibb washer, can be replaced without removing valve from line.

Constructed with a red brass body, model contains a stainless steel control spring that is factory set to relieve water from tank when pressure exceeds relief setting. Pressure settings are adjustable from 50 to 200 psi; this permits substantial inventory reductions through elimination of valves at varied fixed settings, the company reports. Rating of valve is 150,000 Btu per hr.

More information? Circle Item 43, postcard, last page.

(Continued on page 108)



For big jobs, TRANE Fans are especially designed for industrial processing and drying and for high-pressure air conditioning systems. Complete range of standard sizes from 12 to 89 inches, for static pressures up to 11½ inches. Capacities to 310,000 cfm.

Choose a dependable Trane Fan for any process or comfort job!

Accurate ratings, rugged construction assure quiet, efficient operation

The fans you choose for your air-moving jobs—process or ventilation—may mean the difference between top performance and inadequate performance. That's why leading consulting engineers turn to TRANE for fans that are designed for quiet, efficient operation . . . simplified installation and maintenance—and available in a complete range of capacities and types to handle any job.

TRANE Fans are *accurately rated* and ruggedly built. Solid workmanship and the most modern tooling assure consistently dependable performance. And each TRANE Fan design has been tested and approved in the industry's most modern and complete testing laboratories.

TRANE gives you a single, reliable source for *all* your air moving jobs: giant Class I, II and III fans . . . Cabinet Fans . . . Utility Fans—all tested under the AMCA and ASHAE Code. TRANE field personnel in 97 offices are available to help you make the best selection for any air moving job.

When you need a rugged, dependable fan for human comfort or industrial process, turn to TRANE. See your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

WANT MORE FACTS? Write on your letterhead for Bulletins: FC Fans, Class I and II (DS-348-F); BI Fans, Class I and II (DS-348-B); BI Fans, Class III (DS-348-C); Utility Fans, (DS-348-U). Cabinet Fans, (DS-348-D). Axial Roof Ventilators, (DS-364-A). Centrifugal Roof Ventilator, (DS-364-C).

For any air condition, turn to

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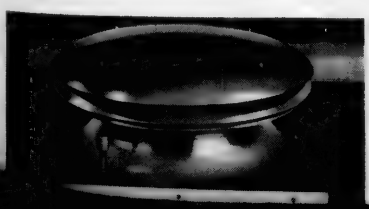
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 19 CANADIAN OFFICES



FOR ROOF APPLICATIONS new TRANE axial flow and centrifugal roof ventilators are especially designed for low silhouette, efficient air movement. Complete range of sizes and models.

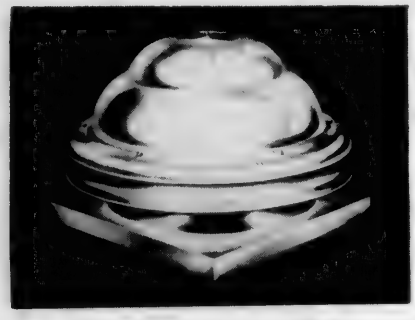
PACKAGED UTILITY FANS for fast, economical installation for hundreds of plant ventilating jobs. Exceptionally smooth and quiet in

(Continued from page 106)

Power Roof Ventilators

Carnes Corporation, of Verona, Wis., announces new power roof ventilator designs to better conform with climatic conditions and architectural requirements. The silhouette of the new models is lower than that of the old.

Motor covers are separated from the fan hoods with an optimum air space, which permits better motor ventilation while retaining a weather-proof design. This air space results in negligible chamber resonance, and causes any mechanical sound pattern to be nullified by the air flow. Another feature is the company's Vibratrol which is a special method of cushioning the motor frame, and is employed on all models. All motors have life-time sealed bearings, and are located out of the air stream.

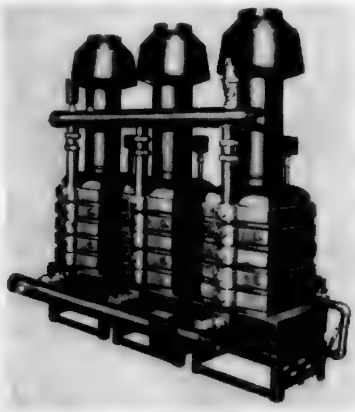


Additional information and performance data curves are available from the company.

More information? Circle Item 44, postcard, last page.

Gas Heating Plant

A gas heating plant manufactured by Hydrotherm, Inc., Northvale, N. J., is said to employ a new concept in the use of gas for heavy-duty hydronic heating. Called Multi-Temp, the system makes it possible to modulate gas input automatically with changing load conditions without impairing the overall boiler efficiency, the company states. Full input is used only for peak loads and when warming up from a cold start. At all other times input is automatically kept to a fraction of full capacity in accordance with actual heating demand.



The heating plant is composed of individual cast iron heat exchangers with horizontal sections manifolded into a common supply and return header. Each heat exchanger has its own combustion chamber and set of gas controls and will fire in response to modulating aquastats provided in the return header. In this manner the return water temperature automatically controls the number of heat exchanger units in operation and prevents wasteful short cycling of the complete heating plant. Substantial fuel savings and increased heating efficiency are said to result.

Because it is composed of a number of individual units, the system is protected against service interruptions. In addition, large heating plants can be installed without sections assembly in the field since each individual heat exchanger is shipped completely assembled with all controls.

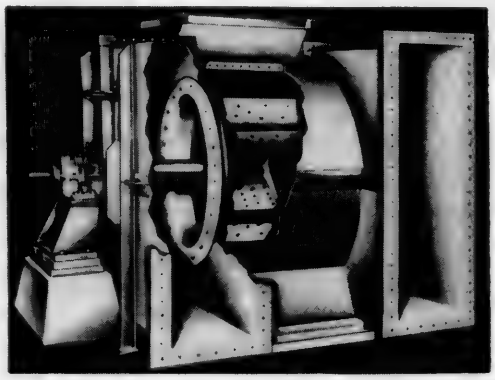
Boilers carry a 100-lb ASME pressure rating, are suitable for space heating and for large volume hot water supply, and are AGA-approved for input ratings up to 3,600,000 Btu and for use on manufactured, natural and propane gas.

More information? Circle Item 45, postcard, last page.

Handles Hot, Abrasive Gases

Series 7000, consisting of heavy-duty and mechanical draft fans, designed specifically for handling abrasive gases at elevated temperatures, is available from Sturtevant Div., Westinghouse Electric Corp., Boston, Mass. In ratings to handle 10,000 to 500,000 cfm and pressures up to 70 inches of water, these centrifugal fans can operate in a temperature range from 20 to 850 deg F.

Fans are made specifically for application where either abrasion or temperature requires radial blading with heavy tapered-blade sections for minimum stress of rotating parts. These include applications such as: steam boiler gas recirculation, fly ash precipitator purging, induced draft for waste heat boilers, rotary kiln exhaust, and similar processes.



Unobstructed gas passage over open radial blades is said to provide maximum self-cleaning action for the blades. In addition, ribbed blade lines are used for extra severe abrasive service. Optional blade and housing liners are easily replaceable in the field.

The housing and inlet boxes for these fans are of welded steel construction with quick opening access doors, braced for working pressures and split for wheel removal.

More information? Circle Item 46, postcard, last page.

(Continued on page 110)

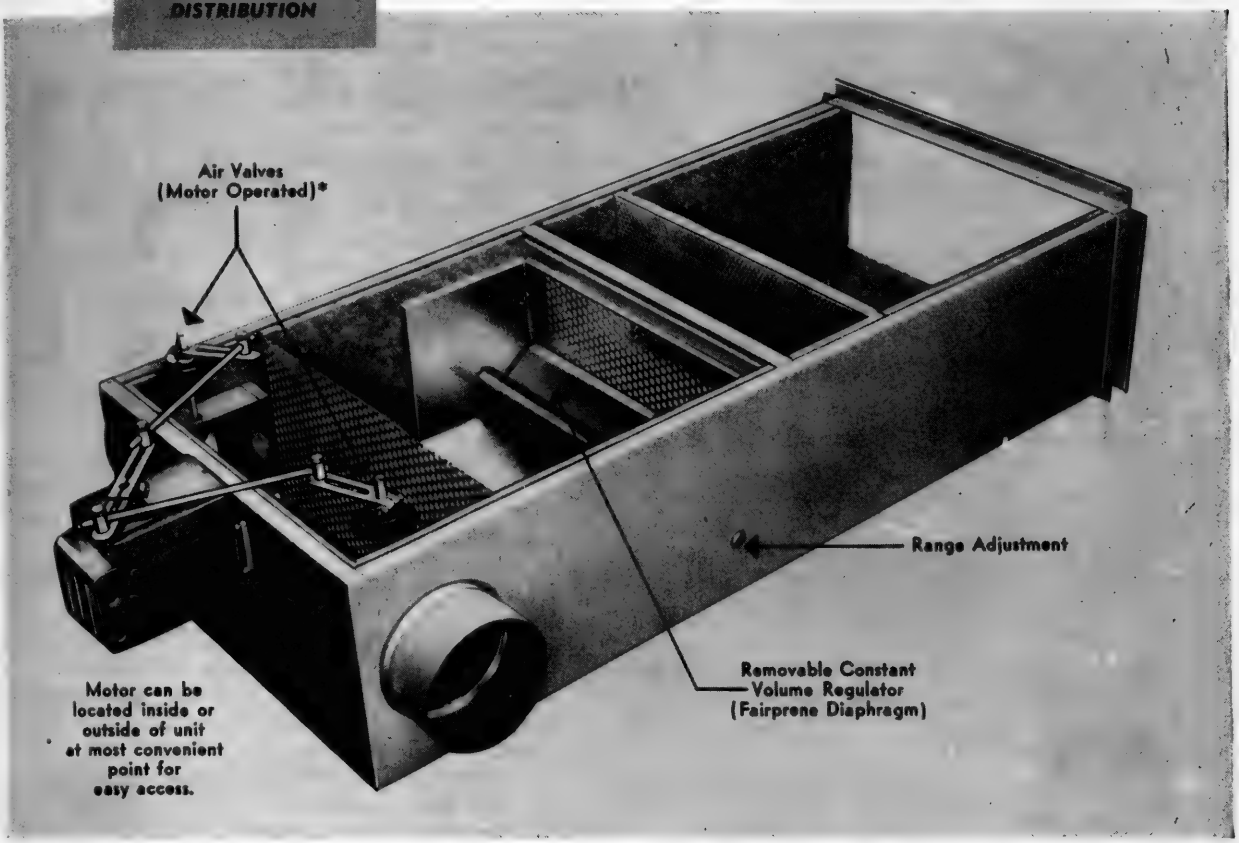
THE MARK OF QUALITY

BARBER COLMAN

Uni-Flo

ENGINEERED AIR DISTRIBUTION

New Self-Contained Constant Volume Control Simplifies Stabilization of High Velocity Systems


Air Valves (Motor Operated)*
Range Adjustment
Removable Constant Volume Regulator (Fairprene Diaphragm)
Motor can be located inside or outside of unit at most convenient point for easy access.

The new Uni-Flo double duct control mixes hot and cold air and reduces it to conventional velocity at minimum noise levels. It is available in octopus, open end, and integral diffuser types.

The unit features an extremely simple and effective self-operated, constant volume regulating valve. No power source or motor operator is required for volume regulation. The valve maintains constant CFM delivery from the box within ± 5% for hot and cold inlet air pressure differences as high as 5:1. A single spring-loaded manual adjustment lets you dial the CFM required.

The hot and cold inlet control valves can be either electrically or pneumatically operated, with the single motor mounted inside or outside the box. The air mixture is held uniform within 1° for each 10° F difference between hot and cold supply air.

On any high velocity double duct installation, this new unit greatly simplifies stabilization and assures continuous, dependable, automatic control. For complete information, dimensional and performance data, write today or call your local Barber-Colman office.

*. . . one source of responsibility when you specify your Uni-Flo double duct control with a Barber-Colman motor.

BARBER-COLMAN COMPANY

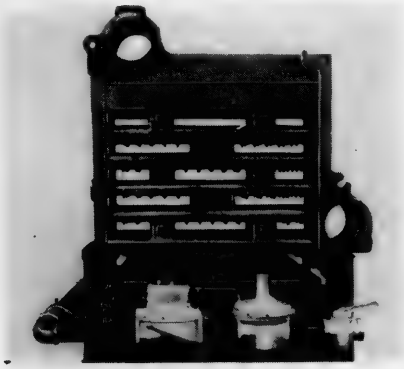
Dept. I, 1102 Rock Street, Rockford, Illinois

(Continued from page 108)

Cast Iron Boilers

Series 150 high capacity, gas-fired, cast iron boilers, offered by The Peerless Heater Co., Boyertown, Pa., boast improved Super water sections with 6-inch ports and tappings said to effect substantial savings in large heating installations.

Design also incorporates 13 gas passages per section, with 6 horizontal tubular water passages with intermediate risers and end headers that form completely boxed



gas passages. It is this "closed H" water tube construction that allows maximum sectional strength, the company states.

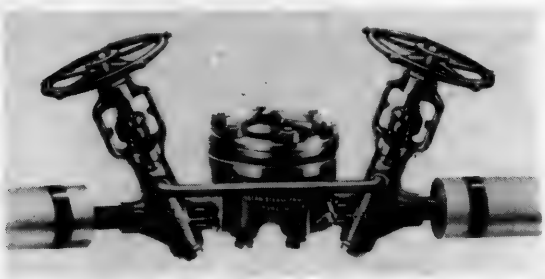
Off-center water tube construction of the boiler sections, when assembled, form a staggered, longer flue travel, forcing a twisting of the hot gases, for maximum heat absorption. Thirty-three sizes are available in ratings from 600,000 to 5,400,000 Btu per hr input for all types of gases.

More information? Circle Item 47, postcard, last page.

Trap By-Pass Unit

The Piping King is a valve combination assembly offered by Velan Steam Specialties, Inc., Plattsburg, N. Y., for use wherever by-pass piping is required for steam trapping. Its labor-saving potentiality can be gaged by the fact that its installation is made with two joints, replacing conventional installations requiring a minimum of 24 joints, the company states.

Any instrument may be by-passed with this assembly, however. The company requires only the face-to-face dimension of the unit to be by-passed in order to produce



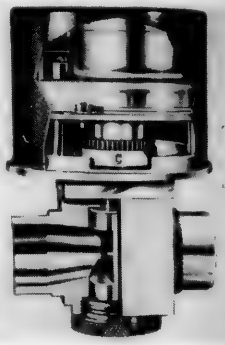
the correct assembly. The assembly illustrated includes an integral strainer-check valve steam trap with two shut-off valves, test and blow down plugs, and a by-pass with a throttling feature.

All traps and valves are made of carbon or alloy steel forgings. Valves can be welded at any specified angle. Connections available are ½ to 2-inch screwed, socket, butt weld, or flanged ends. Pressures of 2500 psi can be accommodated to maximum temperature of 1150 deg F.

More information? Circle Item 48, postcard, last page.

Motorized Zone Valve

A motorized zone valve is announced by Regent Engineering Co., Wood Dale, Ill. Operating on low voltage upon a signal from its own thermostat, this compact multiple zone control on any valve provides automatic new or existing hot water heating system. Its slow cycle of operation produces a desirable modulating effect, the company reports. Valve draws no current in either the open or closed position.

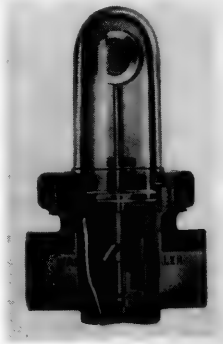


Features of valve include low overall height, position indicator, manual control, lifetime pre-set seal, and auxiliary set of contacts for operating circulator or ignition without the use of further control apparatus.

More information? Circle Item 49, postcard, last page.

Flow Indicators

Available from Walker Crosweller Div., McIntosh Equipment Corp., New York, N. Y., are Arkon flow indicators. A simple, reliable safety signal, this indicator shows at a glance whether flow is taking place. Clearly visible from a distance, even in a bad light, a chromium plated ring spinning under a toughened glass dome has definite movement which precludes chance of misreading.



New variable flow model, illustrated, can be easily reset in the field for high or low range, and is available with die-cast brass body in ½, ¾ and 1-inch pipe sizes for flows from 0.72 to 24 gpm. Other models are available for flows from .075 to 120 gpm in pipe sizes up to 3 inches.

Useful wherever there is circulating water or oil, indicator has specific applications in cooling water to air compressors, refrigeration equipment, and condensers, and lubricating oil to bearings and gear trains.

More information? Circle Item 50, postcard, last page.

(Continued on page 112)

ARCHITECTS and ENGINEERS: Skidmore, Owings & Merrill
GENERAL CONTRACTORS: Chell and Anderson
HEATING and PROCESS PIPING: Wm. A. Pope Co.
AIR CONDITIONING and VENTILATION: Cicero Sheet Metal Co.

Efficient Manufacture Employee Well-being

both aided by Clarage "air" in new Avon cosmetics plant

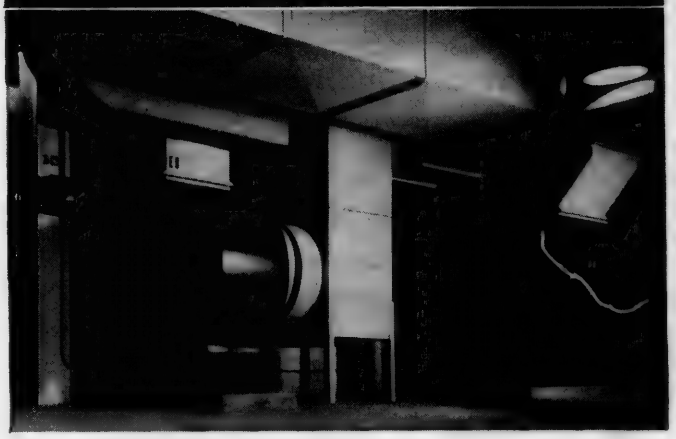
Here is much more than a thoroughly modern manufacturing facility. Here is a national sales center as well.

It's the new Avon Products, Inc., plant at Morton Grove, Illinois. From it flow the widely popular Avon cosmetic products. To it come members of Avon's door-to-door sales organization for training and sales meetings.

Air conditioning, thus, has a dual role to play in this structure — for employee comfort and for efficient manufacturing processes.

As for so many other noteworthy buildings, Clarage equipment was selected — some of which is shown on the right. On the job are Clarage Ready Unit ventilating sets, system fans, and Multitherm air conditioning units, including the famous Blow-Thru units pioneered and perfected by Clarage for multi-zone service.

You, too, will find it profitable to specify Clarage for your next assignments — no matter how large, how small. CLARAGE FAN COMPANY, Kalamazoo, Michigan.



CLARAGE ... *dependable equipment for making air your servant*

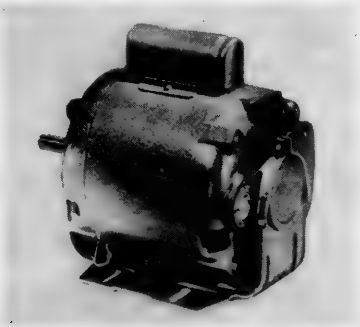
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

(Continued from page 110)

Motors for Fan Drives

Quality performance is built into single phase motors for fan drives being offered by Electric Motor Div., A. O. Smith Corp., Tipp City, Ohio. The complete line can fit all the needs of manufacturers of air moving equipment requiring motors in the ⅓ to 3-hp range, the company states.

Suited for air conditioning equipment, ventilation and exhaust fans, models in the 115/230-volt size are avail-



able in ⅓ through 1½-hp ratings, with 230-volt models available in 2 and 3-hp ratings and in both 1800 and 3600 rpm speeds. All models feature terminal boards for ease in connecting line leads on product assembly lines. Another feature is dual rotation, with all fan duty motors wound for either direction of rotation.

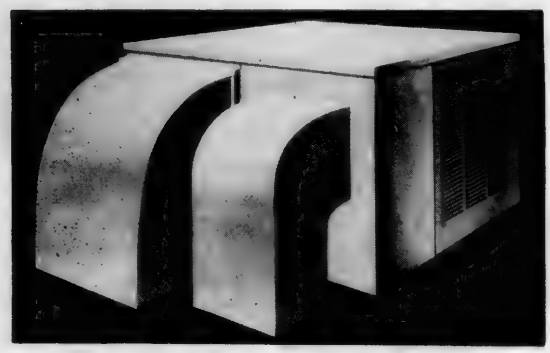
Dynamically balanced rotors, thorough ventilation, precision machining, and custom engineered design of electrical and magnetic circuits aid in producing an unusually quiet operation, it is reported. For further sound-proofing, molded Neoprene rings on bearing hubs isolate motor and fan from motor mount, suppressing any fan vibration.

More information? Circle Item 51, postcard, last page.

Small Central Conditioners

A series of hermetic packaged central air conditioners for outdoor or semi-outdoor installation is announced by The Mathes Co., Fort Worth, Tex., a division of Glen Alden Corporation. Models are available in 2-, 3-, and 5-ton capacities.

Designated as HAH (horizontal air-cooled hermetic),



series includes heat pump models (HAH-HP) as well as models for cooling only. Units are shipped fully assembled, charged with refrigerant, hermetically sealed, and wired for immediate installation. The only work required is setting the unit in place, connecting it to the duct system, and tying onto the power source. Because of its compact, self-contained design, the units are likened to king-size room air conditioners with duct connections.

All models are completely weatherproofed and will carry UL approval for outdoor installation. Cabinets are 16-gage, cold rolled steel finished in epon-baked enamel. Electrical components are enclosed in a weatherproof box within the cabinet. Phenolic-treated, laminated base is said to provide greater structural rigidity and longer life than a sheet steel base.

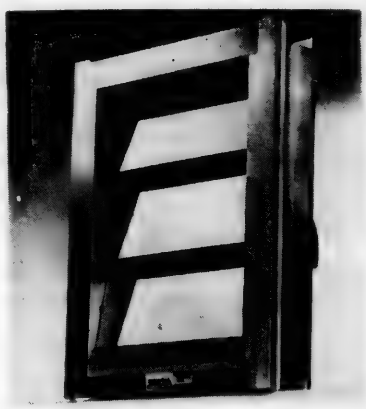
Adaptable to flat roof or ground installation, either entirely outdoors or through the wall, these models are designed to meet a need for a packaged type unit adaptable to a wide range of commercial, industrial, and institutional applications, and for certain residential installations, a company spokesman said.

More information? Circle Item 52, postcard, last page.

Adjustable Louver

Model FL88 aluminum adjustable link fusible louver offered by Extruded Louver Corp., Newark, N. J., permits complete freedom of blade positioning.

Blades may be adjusted to opened, closed, or any intermediate position. At all times the stainless steel



spring will take over and move the blades to desired position when the fusible link is broken by the heat of fire.

A neater appearance is achieved by concealing the fusible link and chain in the louver jamb, the company states. This eliminates unsightly, cumbersome hardware on the back of the louver and protects the mechanism from damage, particularly reducing its exposure to corrosion. The absence of exposed hardware also allows screening to be placed on the back of the louver rather than on the face, thus providing additional louver neatness.

Job-engineered to any size, the louver may be supplied for operation by crank, motor (electric or air), pole, rotor type gear, or by gang operation.

More information? Circle Item 53, postcard, last page.

(Continued on page 114)

Bethcon: not too soft, not too stiff

Next time you get a piece of galvanized sheet in your hands, flex it back and forth a few times to get the "feel" of it. If that piece of steel just happens to be Bethcon, we'll bet it feels just right. Not limp and lifeless, not stiff as a board, but full of life and workability.

Translate that into terms of shopwork and finished product. It means that Bethcon will form up readily on your brakes and lock-formers. And it also means that the completed ductwork will be strong and rigid, ready for many long years of trouble-free service.

There is, of course, a very sound reason for Bethcon's ideal qualities. Our continuous galvanizing lines at Sparrows Point, Maryland, are of the very latest design, and include a continuous annealing process which gives the sheet just the right blending of strength and ductility.

Continuous galvanizing also bonds the zinc to the base metal much more tightly than conventional methods; so tightly, in fact, that the coating will not flake off even when the sheet is bent back on itself. It also does away with the old familiar bead on the drip end of the sheet.

You can order Bethcon sheets in cut lengths or coils, 13-ga and lighter, in either plain open hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal, depending on your requirements. For further information, just get in touch with the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

(Continued from page 112)

China Lavatory

A lavatory with an off-center curved bowl and a wide integral vanity ledge is announced by Plumbing and Heating Division of American-Standard, New York, N. Y. The china fixture, named the Sherrilyn, is designed primarily for residential use, but its functional china

ledge and 24-by-20-inch dimensions make it specially suitable for hotel and motel installations, the company states.

Major feature of the new fixture is its curved planes and off-center styling, as illustrated. Unit also features a concealed front overflow, anti-splash rim, and an integral soap dish with retaining lip and drainage to the bowl. It may be installed as a free-standing unit with legs and towel bars and may be used with either centerset or spread fittings in Quality or Monogram trim. In a motel or hotel installation, it also may be equipped with an ice water spout and a soap dispenser. Available in white and eight colors.

More information? Circle Item 54, postcard, last page.

Double Long Turn Drainage Fitting

A new DWV copper double long turn baffle T-Y drainage fitting, said to positively eliminate cross flow in back-to-back plumbing installations, is introduced by Mueller Brass Co., Port Huron, Mich. Complete freedom from cross flow is made possible by the steep pitch of the

branches, and by placing baffles well below the center line of the side openings, as seen in half-section at right.

Compact design of this Streamline fitting makes possible faster, easier installation of either floor or wall fixtures because of its shorter laying length. It is also suited for the newer wall hung closets. The double long turn fitting is made in accordance to A.S.A. Standard B16.23 for drainage, and is the first of this type offered for all-copper installations, the company states. It is one of a complete line of Streamline DWV fittings manufactured by the firm.

More information? Circle Item 55, postcard, last page.

Recessed Electric Convectors

A line of recessed convection electric heaters, ranging in output from 500 to 3,000 watts, or up to 10,246 Btu per hr, is announced by Circle-Air Industries, Inc., Brooklyn, N. Y.

Back-to-back mounting of company's black heat elements, the manufacturer states, permits up to 50% reduction in the size of the convectors with no reduction in capacity. Installed units protrude only 2 inches from the wall.

A double-wall construction is incorporated, which, with finned element, sets up a secondary flow of heated air, saving heat that might otherwise be wasted through the wall. The result is said to be more heating per unit of electricity. Units are approved by the Underwriters Laboratories and are guaranteed by the company for 5 years.

Temperature is controlled by built-in thermostat with pilot light. Cabinets are finished in chrome, white, hammertone grey, and tan.

More information? Circle Item 56, postcard, last page.

Thermostats Install Quickly

A modernistic die cast case is combined with an advanced chassis in a line of Imperial thermostats being produced by Swan Mfg. Co., Vancouver, Wash.

Unique binding terminals provide fast installation, says the manufacturer. To make connection, a straight wire is slipped under a heavy brass saddle and clamped down with a No. 10 screw. This is said to end time-consuming forming and bending of heavy wire.

Micro switch enclosed in dustproof housing creates positive snap action to stop chatter and arcing. Frequent and induced cycling offers a heat anticipating effect to maintain even temperatures.

Heavy die cast case is finished in tan hammertone baked enamel, and has a gold-colored center grille. Capacities of 15, 20, and 25 amp for wall mounting and in specially designed cases are available.

The manufacturer states that thermostats actually give best performance when carrying the full, or close to the full rated ampere load. Substantial savings are said to be made by selecting the proper thermostat for each load.

More information? Circle Item 57, postcard, last page.

(Continued on page 116)

Complete-line air-conditioning lets Worthington dealers

CUSTOM-QUOTE EVERY JOB!

Probably the most complete line of air conditioning equipment in the world—*Worthington, naturally*—is signing on a select group of new air conditioning dealers—*yourself, possibly?*

Many, many different models permit these *fortunate* dealers to put together the most efficient and economical combinations of air conditioning equipment for any *specific* job. Handling *exactly* the right equipment for every air conditioning problem eliminates equipment compromises, means these *smart* dealers can "custom-quote" on every job. And behind this job-tailored equipment stands 70 years of respected Worthington experience and front-line service. (Incidentally, these same *intelligent* new dealers will find that Worthington equipment is backed by a 5-year warranty which includes a generous dealer labor allowance.)

Interested in quoting on equipment fashioned to the job, not jobs fashioned to the equipment? Interested in increasing your sales, cutting down on lost orders? If so, *Worthington wants you—and you'll want Worthington.* Write today for the complete air conditioning story. Worthington Corporation, Air Conditioning and Refrigeration Division, Section 12-4, Harrison, N. J.

WORTHINGTON

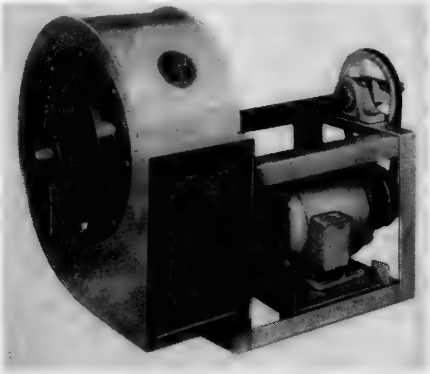
WORTHINGTON'S COMPLETE COMMERCIAL AND INDUSTRIAL AIR CONDITIONING LINE INCLUDES:

Flexi-cool line: Air-cooled, ceiling-mounted, split systems • Water-cooled, self-contained, ceiling-mounted units • Smallest floor-mounted unit available • Hang it, lay it down, stand it up Vertical and Horizontal cooling coils • Remote water-cooled packaged unit • Water-cooled self-contained packaged unit • Air-cooled packaged units • Air-cooled condensers • Air-cooled condensing units • Packaged water-chillers — hermetic and open • Reciprocating compressors • Air handling units • Evaporative coolers • Evaporative condensers • Fan and coil units

(Continued from page 114)

Package Ventilating Units

A line of low-cost package ventilating units, called Fan-Pac, is announced by General Blower Co., Morton Grove, Ill. Units are designed to exhaust air from small enclosed rooms, commercial dryers, restaurant steam tables, hoods, and vats where gases and odors need removing. Fans can be given special coatings to resist corrosive gases.



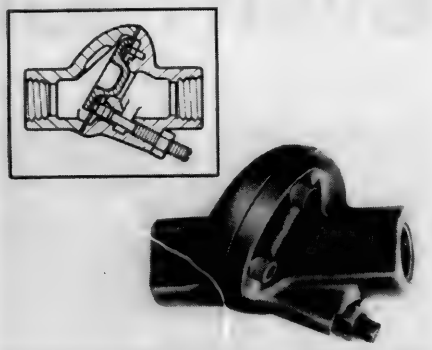
Eight direct-drive models and two belt-driven models are available. Direct-drive exhausters deliver up to 2290 cfm, and belt-driven models up to 1800 cfm. Standard finished for all models is a weather-resistant, light acid-resistant zinc chromate primer.

More information? Circle Item 58, postcard, last page.

Flow Control Valve

A low cost flow control valve, said to permit unusually precise control of air, gas, or low pressure hydraulic flow with unrestricted return, is announced by Valvair Corp., Akron, Ohio.

Known as Micro-Trol, the valve features locked screw adjustment and a unique combination of controlling elements, a threaded stem and molded nylon flapper. The lower range of flow rates is metered by adjusting the position of the ground cylindrical stem within a concentric bore in the valve body. As the regulating portion of the stem clears the bore, the stem end contacts the flapper, lifting it off its seat. Flow is then controlled by the clearance between the flapper and seat. Thus, flow is regulated with fine adjustment, from cut-off to full flow. On return, the flapper lifts clear, affording unrestricted passage of the controlled medium. Flow rate adjustment is retained by an external lock nut on the slotted adjusting stem.



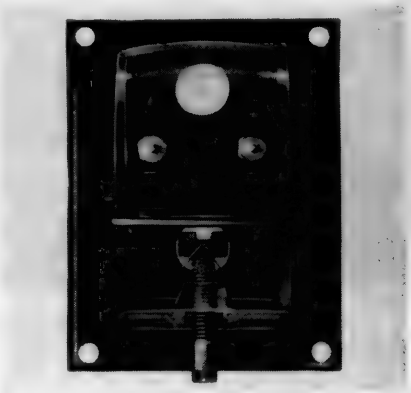
Valves are available in sizes ranging from ¼ through ¾-inch NPT. Flow area through the valve is said to exceed nominal rated pipe size. Valve body is of cast Navy M bronze, stem is stainless steel, and flapper is molded nylon. An O-ring seals and retains the stem.

More information? Circle Item 59, postcard, last page.

Air Filter Switch

Model MNE air filter service switch, for operating a warning light to indicate the need for air filter replacement, is offered by Bacharach Industrial Instrument Co., Pittsburgh, Pa. The switch is particularly suited for central heating and cooling systems in domestic installations and packaged air conditioners in stores and offices, as well as for room air conditioners, unit ventilators and similar cooling and ventilating appliances, the company states.

This switch accurately senses when it is time to change air filters, and closes the electrical circuit which causes the filter warning light to glow. Certain thermostats are currently offered with built-in or accessory filter warning lights, or such a light may be installed separately. It is claimed that the switch guards the operating efficiency of the installation and keeps filter maintenance costs to a practical minimum, since washing of permanent-type filters is done only when necessary, and replacement-type filters are not discarded too soon.



Suitable for either single pressure connection (between filter and blower) or differential pressure connections (across the filter) using ½-inch ID hose, the switch is easily adjusted in the field to signal dirty air filter resistance corresponding to any selected pressure differential across the filter between the limits of 0.05 and 1 inch of water. The switch is 2⅜ inches wide, 3⅛ inches high, 2½ inches deep; weighs 5 oz; and has an electrical rating of 0.25 amps at 26 volts a-c or d-c.

More information? Circle Item 60, postcard, last page.

(Concluded on page 118)

PROVE IT TO YOURSELF

...how much stronger...how much safer

Glasfloss® fiber glass Safety-Grille* filters really are

*TRADE MARK

MAKE THESE TESTS...

1. Bend it—and the new Glasfloss Safety-Grille Filter bounces right back to its original shape. Old type metal-grille filters don't. Unless you re-bend them, they stay bent out of shape and can cut down filtering efficiency. Strong construction of Glasfloss Safety-Grille Filters means less chance of damage in transit, in storage, in handling.

2. Feel the grille edge—it's chipboard, and perfectly safe! No sharp edges—no cuts, no scratches to worry about!

For maintenance personnel, the new Glasfloss Safety-Grille eliminates any danger of cut hands or wrists and possible infection when changing filters.

Plus these features... Glasfloss Safety-Grille Fiber Glass Filters . . .

—have same available filtering area and initial pressure drop as old-type filters
—are tested and proven in service
—are approved by Underwriters' Laboratories, Inc.

Make these tests: Try PPG's new Glasfloss Fiber Glass Safety-Grille Filters in your heating and air conditioning systems. Get top filtering results! They're available in a complete range of sizes from your local distributor or PPG Warehouse.

A Product of Pittsburgh Plate Glass Company

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

FIBER PG GLASS PITTSBURGH PLATE GLASS COMPANY

(Concluded from page 116)

Emergency Air Conditioner

Trailer-mounted emergency air conditioners are available from Ready Cool, Inc., New Orleans, La. Capacities range from 20 to 60 tons. Units are chilled water systems using ice as a refrigerant.

Applications include air conditioning of commercial or institutional space, or for rapid cooling of heaters,

furnaces, boilers, etc. Photo shows unit used to cool high school room containing Atomic Energy Commission Atoms for Peace exhibit. Application of this type of air conditioning is said to greatly facilitate repairs and maintenance of normally hot facilities.

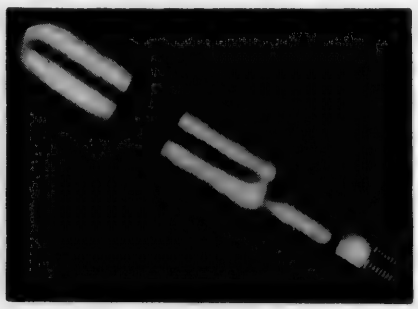
Filters are of the throw-away type. Cooling and dehumidifying coils are aluminum finned, copper tubing through which the ice-chilled water circulates. Industrial internal combustion engines are normally supplied, but electric motors may be specified. The services of a skilled refrigeration engineer are not required for operation, the company states.

More information? Circle Item 61, postcard, last page.

Water Hammer Eliminator

A water hammer eliminator, called Super-Cushion, is added to its line of specialty products by Kam Products Corp., Brooklyn, N. Y.

Engineered to eliminate costly leaks resulting from



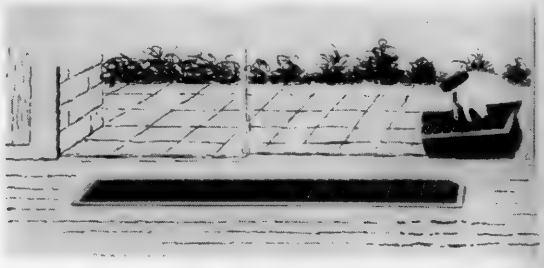
damaging shocks which occur when water is suddenly cut off when using automatic or manually controlled water pumps, washing machines, flush valves and other appliances, the eliminator is said to give a permanent air cushion.

Unit easily installs in any angle or position, is constructed with a strong and extra flexible Neoprene cylinder, and has a one-piece, non-corrosive seamless copper alloy casing. The shock absorber has a non-slip wrench gripping surface and comes with ¾-inch male, and ½-inch female threads.

More information? Circle Item 62, postcard, last page.

Perimeter Floor Convectors

Electric perimeter floor convectors in two sizes and three capacities are available from Wesix Electric Heater Co., San Francisco, Cal. Although the units may be considered a distant relative to the floor furnace, the company states, they bear a closer kinship to the baseboard panel in operation and function. They provide perimeter heating along window walls, beneath sliding glass doors, and in places where wall space is not available.



Heating elements are of the low temperature, high velocity type said to assure moderate grille temperatures —below 150 deg F—for safety, yet providing gentle upward flow of convected warmth. Overtemperature control turns the heater off should air flow be accidentally cut off.

To clean, the grille and attached inner assembly is lifted out, as illustrated in inset, automatically disconnecting the power and exposing an unobstructed outer can for cleaning.

Sizes are: 36½ by 4⅞ inches and 52½ by 6⅜ inches, and in 1250, 2000 and 3000 watts. Depth is 11 inches. One or more convectors may be installed in a room and controlled by a single wall mount thermostat, up to a limit of 6000 watts. Standard finish is hammertone bronze. UL listed and approved.

More information? Circle Item 63, postcard, last page.

Pressure Reducing Valves

A new handwheel and ball bearing adjusting screw assembly, complete with finger-operated teardrop lock nut, is now standard equipment on all piloted pressure reducing valves and optional on pressure reducing valves available from Jordan Industries Sales Div., OPW Corp., Cincinnati, Ohio.

Besides allowing simple and precise setting of control pressure without tools, the company states, the ball bearing movement eliminates torque force on the main spring, allowing more accurate regulation.

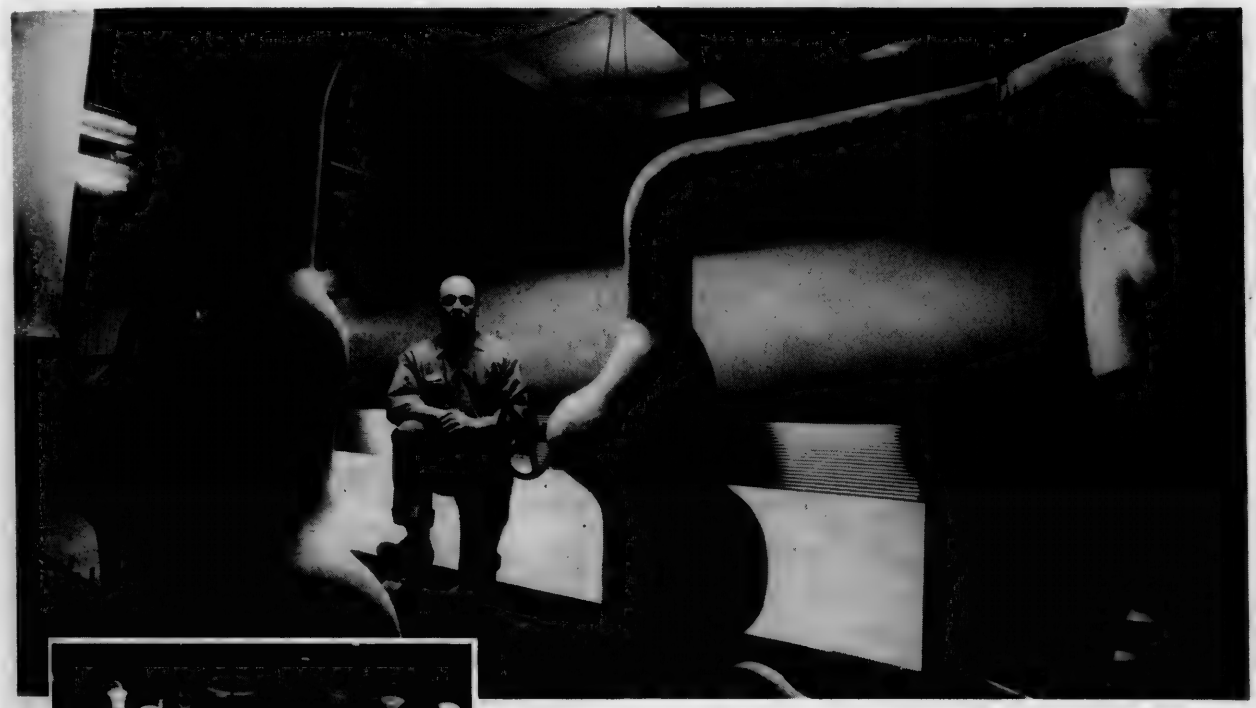
Valves are available in ½ to 2½-inch sizes, 250 psi bronze, and 125 psi iron.

More information? Circle Item 64, postcard, last page.

This is National Aluminate Corporation, near Chicago... an industrial chemical company that provides industry with water and petroleum treatments and related facilities.

Gas-fired Carrier Automatic Absorption Refrigeration

- cuts operating expense
- lowers installation cost
- provides quiet, vibrationless operation
- answers space and weight problems
- automatically adjusts to varying loads



"Now we have trouble-free, economical cooling...thanks to our GAS-fired CARRIER absorption refrigeration"

JOSEPH HUBEK, National Aluminate

"Our new 340 ton capacity gas-fired Carrier Absorption Refrigeration unit now provides cooling for our general office and laboratory. At present we're cooling over 100,000 square feet, effectively and economically."

Put your heating system on a year 'round paying basis.

The absorption refrigeration unit makes use of one of the oldest and most reliable principles of refrigeration. No prime mover is required, only low pressure steam or hot water. Seasonally idle or excess boiler capacity can be put to use on a year 'round paying basis. With gas as the boiler fuel, operating costs are cut to a minimum. This gas-fired Carrier machine operates without noise and vibration ... and because it is so compact and light weight, it can be put almost anywhere – from basement to roof.

This is only part of the story of the efficiency and economy of specifying gas-fired Carrier Automatic Absorption Refrigeration equipment. Specific performance, engineering data and cost details on the economy of gas refrigeration are yours for the asking. Just call your local gas company, or write to the Carrier Corporation, Syracuse, New York. *American Gas Association.*

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Prelubricated Ball Bearing Life Is Still Undetermined

Manufacturers of fans for heating and air conditioning units have sought a bearing that can give years of attention-free, noiseless service. The solution seems to be in the resilient-mounted prelubricated ball bearing. The life span of these bearings is still undetermined, however, as a pair of them, taken from a Clarage Fan Company furnace fan after 20 years of service, without lubrication, were found to be unimpaired.

The bearings in question were Type RS-1, introduced by Fafnir Bearing Co., New Britain, Conn., in 1938. They were removed from his own furnace fan by R. F. Ware, Clarage purchasing agent, only because he was curious to see how they had withstood 20 years of service. Sometime during the life the original grease had oxidized and dried out, it was discovered upon examination in the bearing manufacturer's laboratory; yet no appreciable wear on retainers, balls, or races, shown in photo, could be detected. During a rigorous spin test, the only bearing impairment detectable was a slight noise in operation attributed solely to lack of lubrication. A small daub of grease would have rendered the ball bearings perfectly suitable for a substantial period of continued service.

Ball bearing seal materials and seal design have been further improved in the last 20 years, Fafnir states, so that the type of prelubricated bearing available at present will render even greater service than the RS-1.

Change in Differential Pressure Opens or Closes Switch

Assume that it is required to indicate, by the closing or opening of an electrical circuit, a change in the relationship between two pressure sources. Examples would be loss of flow through a pump due to pressure change from suction to discharge, and change in flow through a filter or orifice due to change in pressure differential across filter or orifice.

A solution would be the use of a Type BB differential pressure control, manufactured by the Mercoid Corp., and designed to operate a single-pole, single-throw, magnetic-type mercury switch from the action of two matched Bourdon tubes.

This control can be utilized to function either from an increase of the difference in pressure between two pressure sources, or from a decrease of the pressure differential. One control cannot provide switch operation from both an increase and decrease of pressure difference. However, this switch provides for reversing the switch operation by interchanging the pressure connections. For example, if the high pressure source is connected to the rear Bourdon tube, the circuit closes on increasing pressure difference. By changing the high pressure source to the front Bourdon tube, the circuit will open on increasing pressure difference.

Sealant Weatherproofs Outside Edges Of Recessed Air Conditioning Units

It is fairly obvious by this time that the increasing number of air conditioning units being installed by individual apartment renters is creating something of an eyesore. One answer seems to be recessed air conditioning units which can be installed in new construction as well as in older, but so-called luxury, high rent apartment buildings. One example of the latter case is the installation of recessed units at the swank River House on East 52nd Street, New York City.

Recessed installation, however, presents certain problems, one of which is weatherproofing the outer edges of the recessed unit to the masonry or other material used to face the building. Ordinary high quality caulking has usually failed after a short time due to condensation, vibration, extremes of temperature, or weather action.

George Grenadier, who handled the installation at River House and, in addition, the weatherproofing of the curtain-walled Lever House, used a sealant based on a liquid polymer manufactured by Thiokol Chemical Corp. It is marketed by different formulators under several trade names. Although a little more expensive than conventional sealant compounds, the Thiokol based compound, applied by caulking gun, as shown, or by pressure-operated systems, is said to give virtually unlimited life.

CASE #100—Another case where General Electric Factory-Assembled Air Conditioning Units proved more economical than field-assembled systems.

General Electric Ceiling-Mounted Units at the Dallas Home Furnishings Mart take no floor space—provide individual temperature control (heat and cool)—are metered for zone control of operating cost.

General Electric Zone-by-Zone Air Conditioning in Dallas Home Furnishings Mart permits

INDIVIDUAL CONTROL OF TEMPERATURE—ZONE CONTROL OF OPERATING COST

Air conditioning the vast new Dallas Home Furnishings Mart presented a 3-way challenge. (1) Over 400,000 sq. ft. to be air conditioned. (2) Provision had to be made for each exhibitor to control his own temperature and operating cost. (3) Floor space was at a premium. The ideal solution was found—in the Zone-by-Zone installation of General Electric Ceiling-Mounted Units.

The entire area gets heating and cooling from the same units. Each exhibit area has its own units *individually controlled and metered. No floor space is used.* No ductwork is required. Noise is held to whisper level. And when the Mart proved so successful that Mr. Trammell Crow, owner, decided to double its size, all that was necessary was to add individual units as individual showrooms were added. No fuss—no alterations—no interference with performance of existing units. This is a typical example of how General Electric *factory-assembled* units meet the most exacting air conditioning requirements.

General Electric's complete line is flexible enough to meet every air conditioning requirement for all buildings—large or small—old or new. Ceiling-mounted units water-cooled up to 7½ tons—air-cooled up to 10 tons. Floor-mounted units—water-cooled up to 30 tons—air-cooled up to 20 tons. Steam and hot water coils available for all models. It will pay you to discover how General Electric Factory-Assembled Units can simplify your planning. For full details write: General Electric Company, Air Conditioning Department, Troup Highway, Tyler, Texas.

Progress Is Our Most Important Product

GENERAL ELECTRIC

NEWS OF THE MONTH

ELEMENTARY SCHOOL

is first packaged heat pump air conditioned school. Summer air conditioning will allow expanded program.

A 24-classroom elementary school in Hampton, Va., said to be the first to be heated and cooled with packaged heat pumps, will open its doors this month. According to General Electric's Air Conditioning Department, Tyler, Tex., thirty-six of whose Weathertron heat pumps were installed in the school, there has been a $6,000 savings in the heating installation over conventional methods, with a bonus of summer air conditioning.

The added feature of air conditioning without additional cost, says W. Boyce Blanchard, or Williams, Coile & Blanchard and Associates, architects and engineers for the John B. Cary school, will allow facilities of the school to be used for educational purposes during the usual off-school months. He explained that the tight situation arising from lack of sufficient school facilities in the area will be, in part, alleviated.

Among cost-cutting design features of the school are: employment of deep classrooms, cutting corridor space and reducing building perimeter; use of skylights to lower ceiling heights to 10 ft; and placement of heat pumps at the exterior walls, eliminating two windows in each classroom as well as ductwork. Perry Electric is the installing contractor.

ICE SKATING RINK

served by cooling system operated by two 100-hp compressors, evaporative condensers, to chill brine.

An outdoor ice skating rink, with a surface 85 by 200 ft., has been added to the recreational equipment available at The Hotchkiss School, Lakeville, Conn.

• **EQUIPMENT**—Ice is produced by spraying water above a grid of steel piping through which brine is circulated at 15 to 20 deg. F. The brine is kept at the desired temperature by a cooling system that includes two 100-hp compressors, two evaporator condensers, a receiver, and a brine mixing tank. This equipment is located in a small building adjoining the rink.

The grid was formed from about 10 miles of Spang CW steel pipe, 1¼-inch diameter. This pipe is laid on steel chairs above a base of stone and covered with washed sand, flush to the top surface. It is arranged in a series of loops, each of which extends the length of the rink, makes a U-turn, and returns to the same end. Headers and return pipes link the loops with the brine cooling system.

This pipe was installed by a five-man crew, consisting of a foreman, a welder, two steamfitters, and a helper.

• **CREDITS**—Ebbets, Fried, and Prentice, of Hartford, were the architects; Peter Carver and Associates, New York City, the engineering consultants; Charles Nickerson & Co., Inc., Torrington, Conn., served as general contractors; Mollenberg-Betz Machine Company, Buffalo, were the prime contractors for installation of the piping and refrigerating equipment. Pipe was made by the Spang-Chalfant Division of The National Supply Co.

INTERNATIONAL CONFERENCE

devoted to heating, ventilating, and air conditioning preceded by inspections of French installations.

Three days of conferences devoted to heating, ventilating, and air conditioning will be sponsored by the Technical Institute of Building and Public Works, Paris, on May 25, 26, and 27, 1959. The conferences will be preceded by a two-day inspection tour of heating installations in the Bourgogne and Lyon regions.

The first day of the conferences will hear reports from representatives in various countries on the subject of the heating and ventilation of schools. Subject of the second day will be gas heating, with emphasis on natural gas. The results of various French research projects will be presented on the last day.

Details and information may be had by writing P. Guerin, Assistant Director, L'Institut Technique du Batiment et des Travaux Publics, 6 Rue Paul Valery, Paris 16, France.

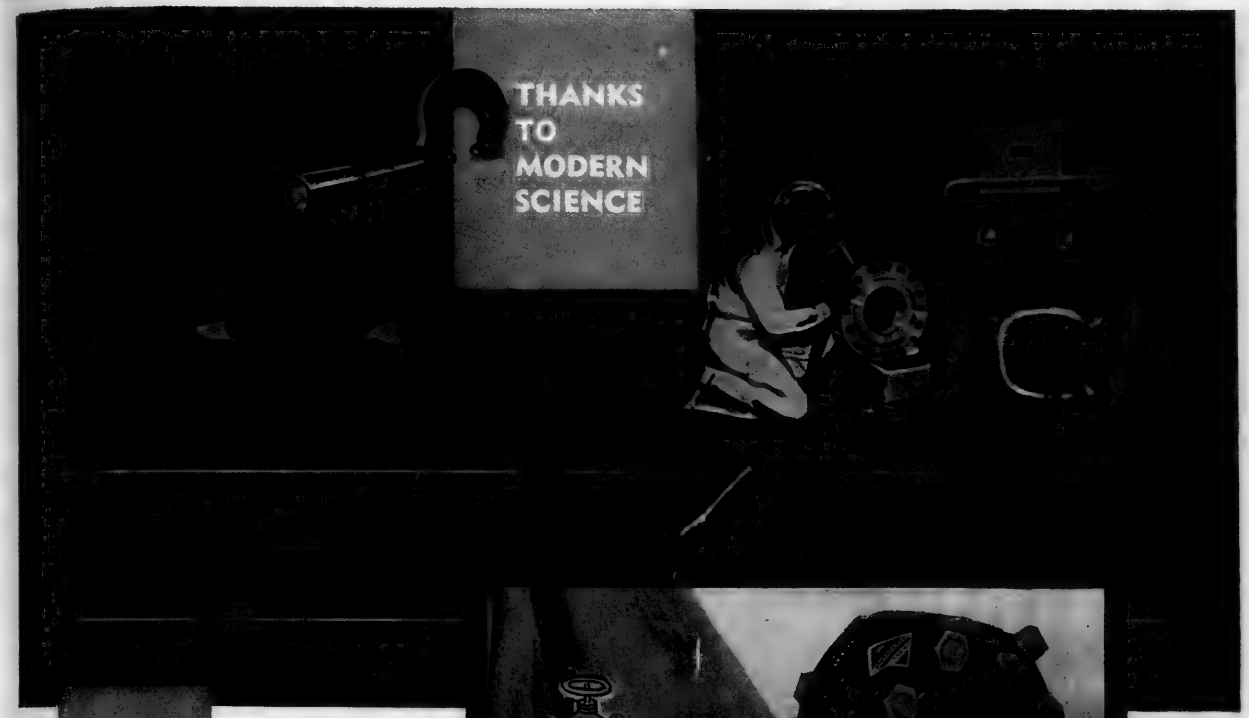
SWIMMING POOL MINIMUMS

proposed by industry committee details standards of construction and design consistent with health, safety.

To those concerned with regulation of public and semi-public swimming pools, the National Swimming Pool Institute, (NSPI) Harvard State Bank Building, Harvard, Ill., has issued a Proposed Minimum Standards for Public Pools. It is hoped by the Institute that these standards will prove to be not only of substantial help to regulatory agencies at all levels of political subdivisions in the development of new sanitary and building codes and in the revising and modernization of existing ones, but that these standards may help bring about some degree of uniformity in these codes.

• **PUBLIC POOLS DEFINED**—An artificially constructed swimming pool other than a residential one is defined as a public pool. Residential pools, wading pools, and spray

(Continued on page 136)



A-11-'57

ELIMINATES FLANGE FAILURE!

Flange failure is expensive! Shutdown time and flow stoppage, to say nothing of damage costs and replacements, can eat up months of profits in no time at all!

But OTM's modern scientific methods — Reflectoscope, Magnaflux, tireless checking and rechecking, protective packaging — prevent all but the perfect flanges and fittings from reaching your job!

Exhaustive testing plus highly skilled machine work result in unequalled Blue Ribbon quality.

FREEDOM FROM FLANGE AND FITTING FAILURE
GUARANTEED*

*by OTM exclusive guarantee and mill test report

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Made of strong neoprene coated cotton or nylon fabrics spiral wire reinforced.
For *all* kinds of fume and dust control, and ventilation uses.
Extremely flexible, durable, and lightweight.
Exceptionally easy to cut, install, connect, reuse, and relocate.
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NEW CATALOGS

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

AIR CONDITIONING UNITS—American Air Filter Co., Louisville, Ky., has published a product bulletin describing the new line of AAF-Herman Nelson air conditioning units. Bulletin No. 786, 54 pages, discusses design features such as the Roll-O-Vent automatic air filter, and details steps in selection of the basic unit and components, capacities, standard arrangements, dimensions, and suggested specifications.

Circle **Item 65** on Inquiry Card

CENTRIFUGAL PUMPS—Bell & Gossett Co., Morton Grove, Ill., has issued two bulletins giving complete selection tables for Series 1531 and 1510 centrifugal pumps. Component parts and service features are detailed.

Circle **Item 66** on Inquiry Card

GENERAL PURPOSE CONTROLS—Catalog GEC-1260C, 88-page publication, covers the complete line of control devices manufactured by General Purpose Control Dept., General Electric Co., Bloomington, Ill. Catalog contains wiring diagrams, dimensions, and application information for each device.

Circle **Item 67** on Inquiry Card

SAFETY RELIEF VALVES—A 4-page bulletin, P-33, prepared by McDonnell & Miller, Inc., Chicago, Ill., covers the company's recently expanded line of Series 230 and 240 safety relief valves for hot water space heating boilers. Bulletin deals with selection and installation of valves for both normal and emergency operation, and gives advantages of the manifold-type relief valve.

Circle **Item 68** on Inquiry Card

PIPE ROTATORS—Pipe rotators for welding and flame cutting pipe are shown and described in a 4-page bulletin published by Cecil C. Peck Co., Cleveland, Ohio. Two models are described. One, the Peck Jr., for pipe up to 5-inch dia, is described as a portable unit suitable for use on construction projects, process and power installations where extensive field alteration and maintenance is a problem. The second rotator, a heavy-duty model designed for pipe to 36-inch dia, is for shop fabrication of welded piping used in completely engineered systems.

Circle **Item 69** on Inquiry Card

(Continued on page 126)

SERDEX
introduces
LOWER-PRICED
humidity and temperature
recorders

New Serdex Model 312C Hygrothermograph measures only 10½" x 7" x 3", weighs just 4½ lbs.

Accuracy and performance guaranteed unconditionally for a full year • Large, 6-inch Chart permits detailed analysis of area conditions • Buy either Hygrograph or Thermograph now; convert to Hygrothermograph later at big cash saving*.

NEW SERDEX HYGROGRAPH with patented animal membrane Sensing Element guaranteed accurate within ±5% over range of 15% to 95%, within temperature range of +32°F to +130°F. (Correction Chart available for temperatures as low as −30°F.) Unit has very low lag constant; reacts almost instantaneously to changes in relative humidity. *ONLY $97.50; add Thermograph later for just $27.50.

NEW SERDEX THERMOGRAPH accurate within ±2°F over range of 0°F to 100°F. *JUST $75.00; add Hygrograph later for only $50.00.

NEW SERDEX HYGROTHERMOGRAPH combines all the advantages of both the above instruments. Sensing Elements synchronized to provide same sensitivity, range lag. ONLY $125.00.

WRITE FOR COMPLETE INFORMATION or order now!

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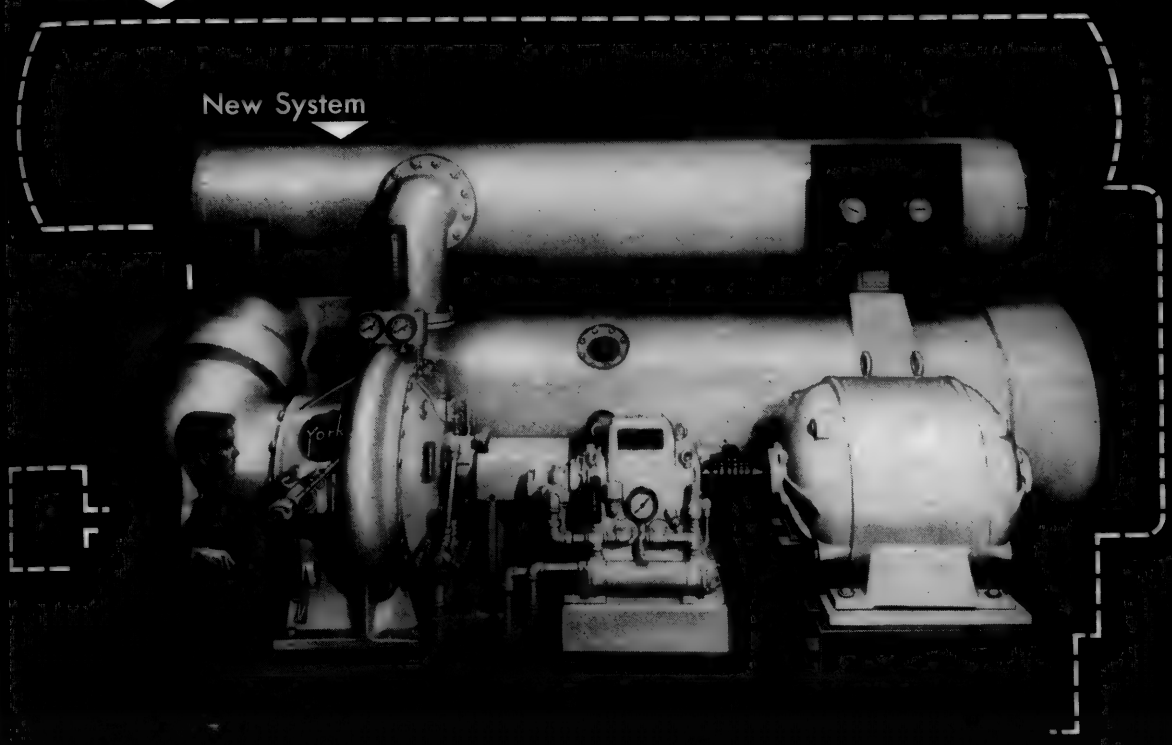
INCORPORATED
Relative Humidity Indicators, Recorders, Controllers
12-E Bowdoin Square, Boston 14, Massachusetts

Wholesalers: Write for information

ANOTHER AIR-CONDITIONING VALUE PACKAGE FROM YORK



TURBO WATER COOLING SYSTEM

- **Number of parts and deadweight cut as much as 400% over previous models!**
- **Widest range of capacities: 100 to 600 tons . . . with single-stage simplicity!**
- **Completely automatic adjustment for all load conditions insures long-run economies!**
- **Quiet, vibration-free operation!**
- **Any prime mover can be used!**

These are features that consulting engineers and contractors have long sought, and now make York's single-stage Turbo Systems an *engineered value* unmatched in the air-conditioning industry:

EASIER INSTALLATION! These compact, lightweight systems require no special foundations; occupy a minimum of space. The advanced single-stage compressor out-performs multi-stage systems twice its size . . . and does away with such equipment as flash coolers, extra float valves, extra piping and its insulation.

MORE ECONOMICAL PERFORMANCE! Stable operation under all load conditions is assured. York Turbos can be run completely by automatic capacity control . . . without supervision. Complicated control devices have been eliminated. There are no oil pumps to start.

SIMPLIFIED MAINTENANCE! The York Turbo is more nearly hermetically-sealed than any other centrifugal system. Contamination of the refrigerant is positively prevented. The use of a lightweight aluminum rotor (the only moving part)—and a small, flexible shaft coupling reduces wear. All running parts are removable as a package for inspection . . . are readily accessible without disturbing refrigerant connections!

These important features are the direct result of York's tradition of designing with the *real cost* of air-conditioning in mind. They are just a few of the many you and your clients may want explained in detail. Check your classified directory for your local York factory representative . . . or write York Corporation, York, Pennsylvania.

YORK CORPORATION

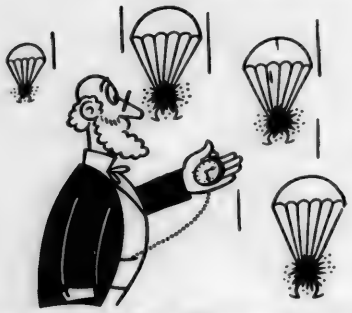
SUBSIDIARY OF BORG-WARNER CORPORATION

IN CANADA: CANADIAN ICE MACHINE COMPANY LTD., TORONTO

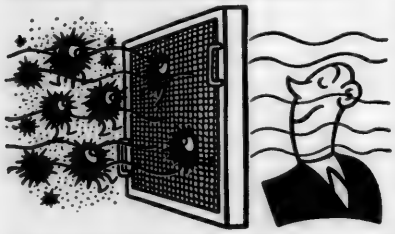
Millions Live Better with York

AIR-MAZING FACTS

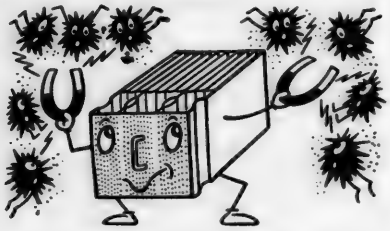
BY O. SOGLOW



LOW-DOWN ON DUST! Microscopic dust particles fall only 100 feet in 278 hours. During this time, a 10 mph wind would carry such dust particles all the way across the United States. Fortunately, you don't have to worry about dust, no matter where it comes from . . . if you use Air-Maze filters to remove harmful particles from air.



BAD AIR GETS FRESH START! Air-Maze air filters keep damaging dust and grit out of hotels, office buildings, stores—wherever clean air is required. Available in a large variety of types and sizes including unit panels, rotating curtains and self-washing electrostatic precipitators.



MAGNETIC PERSONALITY! More than 90% of all air-borne dust and pollen, even smoke particles, are drawn right out of the air by Electromaze electronic air filters. Used from coast to coast wherever super-clean air is desirable, Electromaze filters are more flexible in size, quicker to install and easier to clean.

FOR AIR CONDITIONING AND VENTILATING EQUIPMENT, ENGINES, COMPRESSORS *or any device using air or liquids*—there is an Air-Maze filter engineered to solve each filtering problem. For new all-line catalog, write Air-Maze Corporation, Dept A-9, Cleveland 28, O.

AIR-MAZE

The Filter Engineers

AIR FILTERS • SPARK ARRESTERS • LIQUID FILTERS
SILENCERS • OIL SEPARATORS • GREASE FILTERS

NEW CATALOGS

(Continued from page 124)

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

OIL-FIRED WATER HEATER — A full-color file sheet, No. 3460, describes the direct oil-fired hot water heater introduced by Petro, Cleveland, Ohio, for domestic and commercial needs. Reference includes specifications and a construction diagram.

Circle **Item 70** on Inquiry Card

ELECTRONIC RECORDER—A bulletin-specification sheet package of literature has been prepared by The Hays Corporation, Michigan City, Ind., describing the company's Universal electronic recorder. Included in the literature are details on the available two types of electronic receiver units (slidewire and differential transformer types), direct pressure and temperature receivers, amplifier, integrator and accessories. Instrument is presently available for recording of pressure, temperature, flow, liquid level, $\%O_2$, $\%CO_2$, $\%H_2$, pH, speed, and other variables.

Circle **Item 71** on Inquiry Card

FORCED DRAFT PACKAGE BOILERS—The Compak forced draft series of water tube package boilers is described in Bulletin No. 1200 published by The International Boiler Works Co., East Stroudsburg, Pa. Boilers are available for low or high pressure hot water or steam generation in a wide range of sizes.

Circle **Item 72** on Inquiry Card

AUTOMATIC VALVES—Published by A. W. Cash Valve Mfg. Corp., Decatur, Ill., is a condensed catalog, P&H-58, with twelve pages containing information on 212 automatic valves. Convenient specification tables make it a good source for quick valve selection. Tables include valve type, pipe size, rating, and shipping weight, and are keyed to the company's current price sheet.

Circle **Item 73** on Inquiry Card

STEAM, HOT WATER GENERATORS — Revised specification sheets, featuring a separate section on hot water generators, have been issued by Cyclotherm Div., National-U. S. Radiator Corp., Oswego, N. Y. Each of company's 10 hot water models is given a complete page, with full description and specifications.

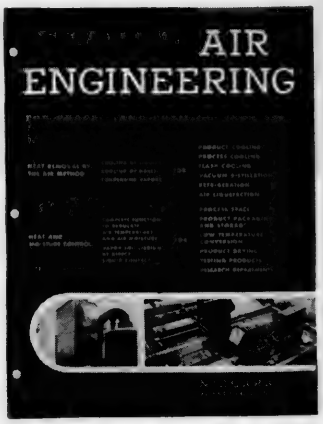
Circle **Item 74** on Inquiry Card

(Continued on page 128)

AIR ENGINEERING by NIAGARA

- AIR CONDITIONING with precise regulation of air temperature and air moisture for processing, for product drying, packing, storing, low temperature conversion, for testing and research.
- "NO FROST" REFRIGERATION for food and low temperature conversion, for testing and operations at extreme low temperatures; for moisture control below the freezing point of water.
- AFTER COOLING and air drying for large air and gas compressors and AIR LIQUEFACTION.
- COOLING ENGINES, COMPRESSORS, HYDRAULIC PRESSES.
- COOLING QUENCH BATHS, FURNACES, INERT ATMOSPHERES.
- COOLING ROLLS, WELDERS, DRAWING OR EXTRUSION DIES.
- PRODUCT AND PROCESS COOLING CHEMICALS OR INTERMEDIATES.
- COOLING LIQUIDS OR GASES IN CLOSED SYSTEMS.
- VAPOR CONDENSING UNDER VACUUM.
- REFRIGERANT CONDENSING.
- ELECTRONIC PROCESS COOLING.

You will reduce your costs, solve your problems of water supply or disposal and get HIGH OPERATIONAL EFFICIENCY with Niagara "Aero"



Write for this Bulletin No. 135

Evaporative Heat Exchangers, After Coolers, Condensers, Air Conditioners or Coolers for these important plant services or processes.

High operational efficiency means: precise temperature for improved product and process quality control, heat removal at rate of input, simple operating conditions, real economy in upkeep, sustained full capacity. It means the lowest expense for up-keep.

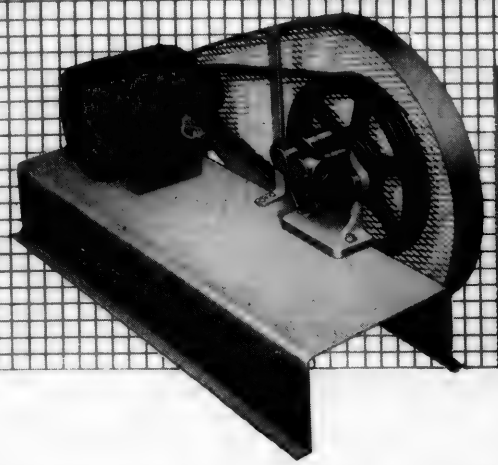
Write for Bulletin 135

NIAGARA BLOWER COMPANY

Dept. HV-9 , 405 Lexington Ave., New York 17, N.Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

from Webster... NEW SUPPLY PUMP EQUIPMENT



to handle no. 6 and 6 furnace oil

Webster direct drive units are motor driven at 900 rpm optimum speed — relatively low speed lengthens pump life. Capacities and pressures of belt driven sets can be varied to meet specific requirements by changing size of pulleys.

call the man from Webster

HEATING DIVISION
WEBSTER ELECTRIC
RACINE · WIS

Now the efficiency and high operating performance of Webster supply pumps are available for commercial and industrial applications requiring the handling of heavy oils. The new Webster heavy oil pumps are built in either direct drive or belt drive units with motors ranging from ¼ h.p. to 2 h.p. Plenty of capacity, too . . . from 28 to 575 gph, with pressures up to 300 psi. Extra large ports mean initially cold, heavy oils can be handled without restrictions.

New Webster pumps are compact, easy to install — require less plumbing. Write for additional information.

Publication A-121

LOW INSTALLATION

AND MAINTENANCE COSTS

. . . plus added years

of dependable service

•

TODD BURNERS

GAS OR OIL

•

PRODUCTS DIVISION

TODD SHIPYARDS CORPORATION

Headquarters:
Columbia and Halleck Streets,
Brooklyn 31, N. Y.

Plant:
Green's Bayou, Houston 15, Texas

TODD NEW YORK, U.S.A.

Another

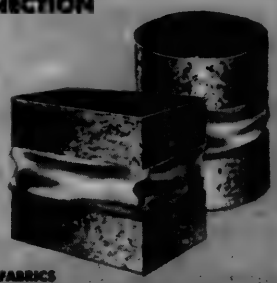
CAINS

COIL OF PROFIT

PRE-FAB-RIC

A PREFABRICATED FLEXIBLE DUCT CONNECTION

Simply pull out desired length from dispenser-type carton. (It pulls out ready to use.)
Roll into round duct or form into square duct and join. Saves 70% time over old methods.
DOUBLE-SAFE-LOCKED



A TYPE, SIZE AND PRICE FOR ALL JOBS

THREE GRADES
Commercial - Economy
Residential

THREE FABRICS
Canvas - Asbestos
Neoprene

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SOLD ONLY THROUGH JOBBERS AND DISTRIBUTORS
Some Territories Open for Manufacturers Agents Calling on Jobbers and Distributors

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Which of these ventilation problems do you want solved?

General ventilation and comfort cooling? Removal of fumes, dust, heat and steam? Air circulation, rapid product cooling and drying?

Power Line

solves it these 5 ways surer:

1. Complete line: Broadest product line of air-moving equipment for every industrial requirement.

2. Certified performance: All Power Line Fans are rated by PFMA and NAFM.

3. Backed by 33 years of specialization in manufacture of highest quality ventilation equipment.

4. Competitively priced to give you important cost savings in initial investment and in maintenance. You get the precisely right product to fit your requirements. You don't over-buy with equipment too large or under-buy with equipment too small.

5. Sold only through qualified ventilation specialists. You get expert technical advice and service from the survey of your requirements right through to the completion of your installation.

YOURS ON REQUEST: Big 20-page Power Line Catalog gives complete facts about industrial ventilation, including selection of proper type and size of fan, calculation of dust resistance, and installation procedures, plus features, dimensions, specifications and performance data. Without obligation write for your free copy of Catalog No. 99B.

POWER LINE FAN COMPANY, INC.

Subsidiary of **Chelsea Products, Incorporated** 639 South Avenue, Plainfield, New Jersey

NEW CATALOGS

(Continued from page 126)

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

PACKAGED AIR CONDITIONERS — Complete specifications and construction data on a new line of self-contained, air-cooled air conditioners are available from Ilg Electric Ventilating Co., Chicago, Ill. The line, designed for both commercial buildings and residences, contains five models: two 2-hp units, two 3-hp units, and a 4-hp unit.

Circle **Item 75** on Inquiry Card

SANITARY DRAINAGE SYSTEMS — Folder C-33, from The American Brass Co., Waterbury, Conn., briefly outlines advantages of Anaconda copper tubing for soil, vent, and waste services. Wide range of cast-brass solder-joint drainage fittings available is outlined.

Circle **Item 76** on Inquiry Card

SHAFT-MOUNTED SPEED REDUCERS— A booklet, entitled Shaft-Mounted Speed Reducers, is available from Westinghouse Electric Corp., Pittsburgh, Pa. The 10-page engineering manual discusses selection, horsepower ratings, dimensions, construction, installation and maintenance.

Circle **Item 77** on Inquiry Card

BOILER, FURNACE CLEANING— A 20-page booklet describing the tools and supplies needed for oil or gas-fired boiler and furnace cleaning is issued by Sid Harvey Inc., Valley Stream, N. Y. Listed are the dust bags and attachments used on various makes of vacuum cleaners as well as soot removing compounds and brushes. Also listed are all makes of replacement oil filter elements, nozzles, ignitors, terminals, couplings, fans and accessories.

Circle **Item 78** on Inquiry Card

WROUGHT IRON TUBE — A technical bulletin, Cold Drawn Wrought Iron Heat Exchanger and Condenser Tubes, is available from Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa. The 10-page booklet cites actual installations in which the use of wrought iron and other metal tubing in the same equipment permits service life comparisons.

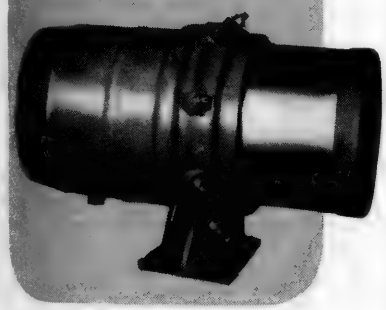
Circle **Item 79** on Inquiry Card

(Continued on page 130)

important points about joints

- Yarway Gun-Pakt Joints are serviced *in the line under full steam pressure.*
- Costly shutdowns eliminated.
- Maintenance records show 1 manhour per year per joint.
- Fewer expansion joints needed per length of pipeline with Gun-Pakt.

YARWAY GUN-PAKT EXPANSION JOINTS



For new Yarway Expansion Joint Catalog EJ-1916 write YARNALL-WARING CO., 104 Mermaid Avenue, Phila. 18, Pa.

go YARWAY with confidence

WHEN YOU PLAN...
TO SAVE COSTS
Factory-trained Cyclotherm engineers will . . . without charge . . . work with you from drafting board to final installation to estimate your steam demands.
TO SAVE TIME
Factory-trained Cyclotherm servicemen are as close as your telephone . . . at any hour of the day, night or week-ends.
TO SAVE SPACE
Cyclotherm Steam Generators range from 15 to 750 hp. . . . from 15 to 200 psi. For industrial and commercial establishments, shipping, institutions.
Select CYCLOTHERM STEAM & HOT WATER GENERATORS

Planning a new building? Remodeling an existing structure? As much as ⅓ smaller than other packaged units, the Cyclotherm Steam or Hot Water Generator allows more space for storage and production. Needs only a minimum-sized, minimum-cost boiler room. Or your Cyclotherm can be placed in a working area. Its radiant heat loss is at a minimum.

Lighter-weight, it costs less to transport. Simpler in design, it requires less rigging time . . . lower rigging costs.

Yet it delivers a guaranteed 80% efficiency . . . pays for itself in a few years in fuel savings alone . . . cuts maintenance costs up to 50%.

Exclusive, patented Cyclonic Combustion combined with simplicity of boiler design produces maximum heat transfer wringing every degree of heat from each fuel molecule . . . wasting none. Does in 2 passes what other combustion methods accomplish in 4. Cyclotherm's even rate of heat transfer eliminates localized, heat-retarding scale and "hot spots." All these features assure you of long life and maximum performance.

FREE **Discover how Cyclotherm can give you more steam for your dollar. RETURN THIS COUPON TODAY.**

YEARS AHEAD IN STEAM & HOT WATER GENERATION
CYCLOTHERM®
STEAM AND HOT WATER GENERATORS

A Division of National-U.S. Radiator Corp., Oswego, N.Y.

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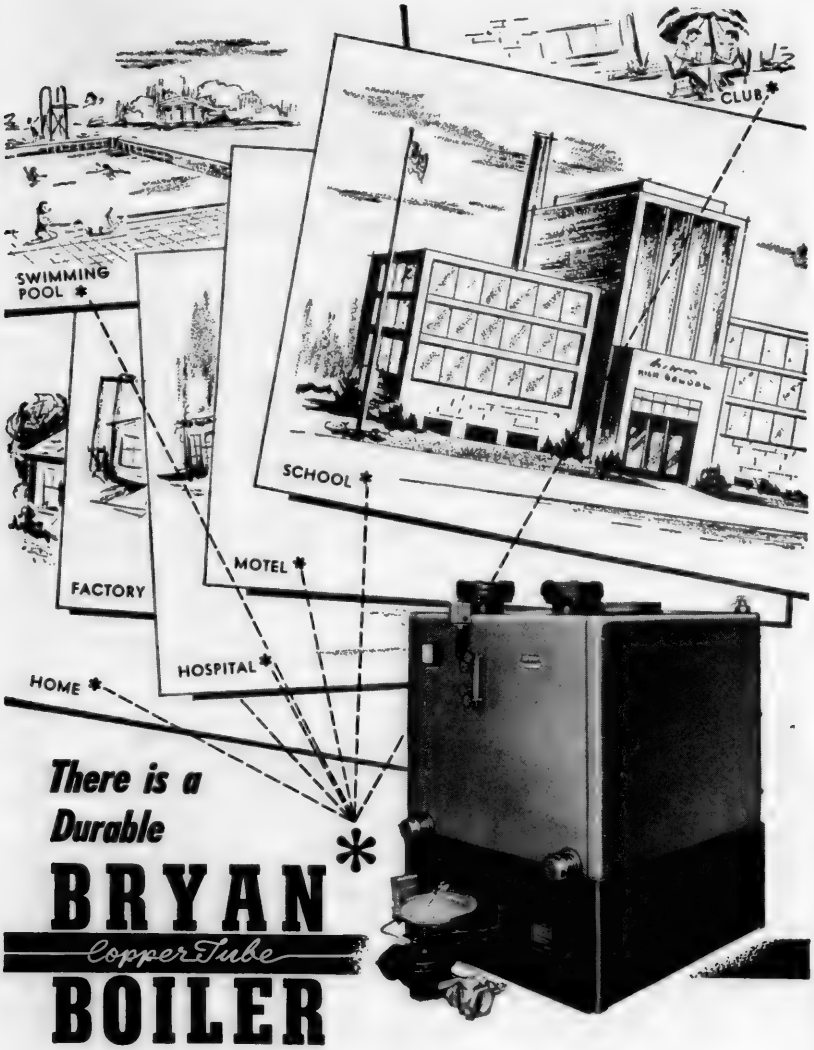
56 E. First St., Oswego, N. Y.

☐ Please send me your illustrated folder on Cyclotherm Hot Water Generators.

☐ Please send me your illustrated folder on Cyclotherm Steam Generators.



There is a Durable

BRYAN

Copper Tube

BOILER

For every steam or water heating application up to 1,800,000 B.T.U. output.

Whether the plans on your boards are for a factory, apartment house, swimming pool or a modest radiant heat home, a detailed check on specifications will point to one of the many Bryan models covering low or high pressure steam, hot water boilers, or indirect water heaters.

The Bryan is a heavy duty, durable boiler made to deliver a lot of B.T.U's in a short period of time. Specially engineered for gas or oil heating, its high efficiency is complemented by years of trouble free service. Requires minimum floor space.

Bryan is the originator of the famous Bryan copper tubes. They are used in both direct and indirect heating units for fast action and elimination of scale deposits.

Bryan Gas Fired Boilers are designed and built to the requirements of the A.S.M.E. code and are also approved by the American Gas Association (A.G.A.)

Send For Technical Information • 2100 Chili Pike

BRYAN STEAM CORPORATION • Peru, Indiana

NEW CATALOGS

(Continued from page 128)

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

PRESSURE RELIEF VALVES— Superior Valve & Fittings Co., Pittsburgh, Pa., has published a 4-page bulletin, entitled Selection of Relief Valves for Commercial Refrigeration and Air Conditioning Applications based on ASA-B9.1 Code. The bulletin, 58-28, is designed to answer many of the problems the refrigeration engineer and serviceman have in choosing the right size of relief valve. In addition to reviewing the major provisions of the Code, the paper gives specific examples and formulas for establishing discharge capacities for all sizes of refrigerant containing vessels.

Circle **Item 80** on Inquiry Card

INDUSTRIAL FIRE PUMPS— Three types of UL-approved fire pumps—horizontal single stage, horizontal multi-stage and vertical turbine multi-stage pumps—are the subject of a profusely illustrated, 32-page bulletin available from Peerless Pump Div., Food Machinery and Chemical Corp., Los Angeles, Calif. Bulletin contains all information and data pertinent to the selection, application and installation of fire pumps for all types of commercial and industrial risks. Included are comprehensive details of the types of approved drives available.

Circle **Item 81** on Inquiry Card

CENTRAL STATION CONDITIONERS — A 72-page catalog for accurate and easy selection of central station air conditioning units from two Weathermaker lines for conventional and multi-zone applications is announced by Carrier Corp., Syracuse, N. Y. Dehumidification coils for direct expansion or chilled water can be selected by either the entering and leaving wet bulb conditions, or apparatus dewpoint temperature method. For heating coil selection, performance curves and rating tables for hot water as well as steam are provided.

Circle **Item 82** on Inquiry Card

CAST, FORGED STEEL VALVES— A 92-page catalog, No. 14, describing a complete line of cast and forged steel valves for power, petroleum, chemical, marine, and industrial applications, is announced by Edward Valves, Inc., subsidiary of Rockwell Manufacturing Co., East Chicago, Ind. Cross-indexing of valves by picture, type, function, and figure number makes reference easy.

Circle **Item 83** on Inquiry Card

HTW SYSTEMS HEATING EQUIPMENT—Bulletin D-327-2, announced by The Trane Co., La Crosse, Ind., includes specialized application information for engineers on the company's lines of heating equipment for high temperature, high pressure, hot water systems.

Circle **Item 84** on Inquiry Card

COMPACT, ENCLOSED MOTORS — The Louis Allis Co., Milwaukee, Wis., offers a 4-page bulletin, No. 2100, on its enclosed Pancake Motors that reduce motor length up to 60% over standard motors. Description and specifications are included.

Circle **Item 85** on Inquiry Card

POWER ROOF EXHAUSTERS—A 6-page brochure on company's power roof exhausters, called Super/Air-Vans, in reinforced Fiberglas construction is available from The Gallaher Co., Omaha, Neb. Brochure contains performance and dimensional data, as well as advantages of reinforced Fiberglas application to power roof exhausters.

Circle **Item 86** on Inquiry Card

SEWAGE DISPOSAL SYSTEMS—A data file from Kenco Pump Div., The American Crucible Products Co., Lorain, Ohio, on septic tank and sewage applications presents a complete round-up of underground and aboveground disposal filter systems, together with engineering data on the company's package alternator, the Kenco-Trol, and heavy-duty septic tank pumps, Models 119 and 130.

Circle **Item 87** on Inquiry Card

SOLENOID VALVES—Bulletin 500 - C from J. D. Gould Co., Indianapolis, Ind., includes pictures and description of company's basic types of solenoid valves, covering a wide range of operating conditions.

Circle **Item 88** on Inquiry Card

SOLDERED AND BRAZED JOINTS — A booklet, entitled Soldered and Brazed Joints in Copper Tube for Refrigeration and Air Conditioning Systems, is published by Copper & Brass Research Association, New York, N. Y. Illustrated, the 8-page brochure covers selection of materials, steps involved in each operation, and general suggestions.

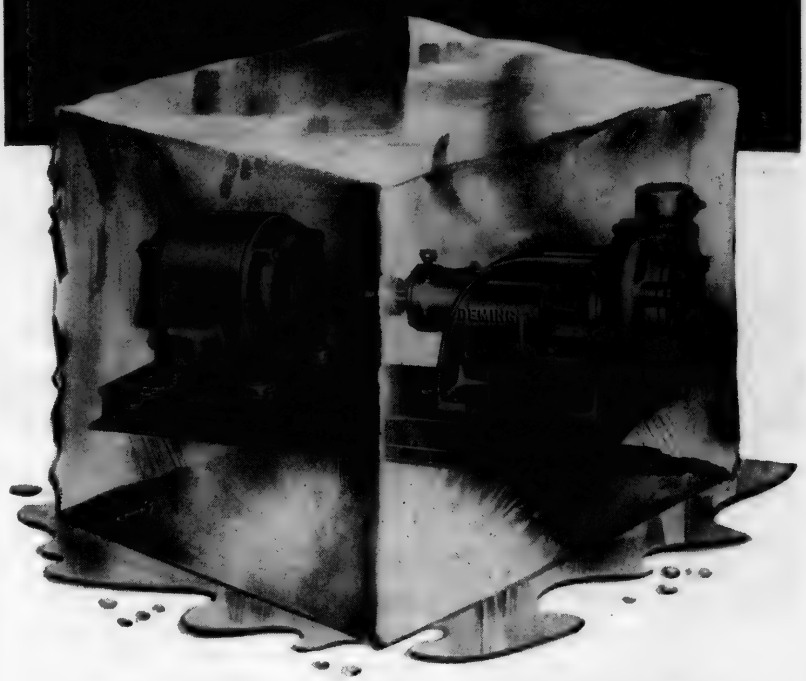
Circle **Item 89** on Inquiry Card

EMERGENCY REPAIR KIT—A Plastic Steel emergency repair kit is described in a bulletin published by Devcon Corp., Danvers, Mass. Chemical and physical properties of product are given, in addition to illustrated product applications.

Circle **Item 90** on Inquiry Card

(Continued on page 132)

DEMING PUMPS...



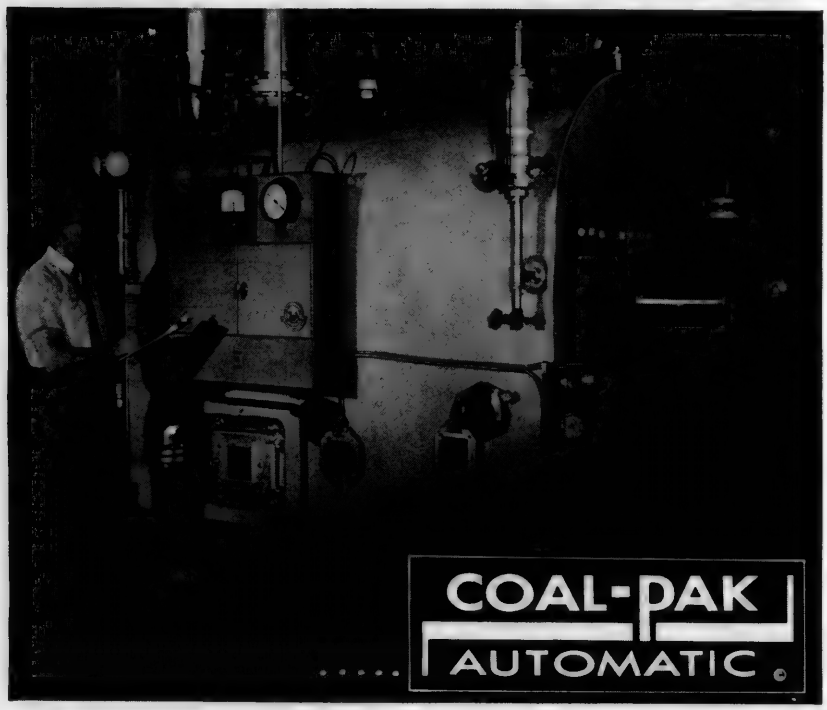
This Deming End-suction centrifugal pump is ideally suited for air-conditioning service. Four-piece liquid end assembly permits easy service and maintenance. Capacities range to 1,000 GPM.

Deming Pumps have proven characteristics that contribute to efficient, economical air-conditioning service, and the big Deming line provides a wide variety of standardized pumps to meet any application.

Bulletins on all Deming Pumps are available. Name your needs and write to:

STOP and SEE

the INTERNATIONAL-BCR



First **FULLY AUTOMATIC package unit complete with combustion controls, automatic coal feed and ash removal system, for burning LOW COST BITUMINOUS COAL cleanly and efficiently.**

Get the facts from your INTERNATIONAL DISTRICT REPRESENTATIVE or write for Bulletin 1100

Developed by BITUMINOUS COAL RESEARCH, INC. RESEARCH -- COAL'S FUTURE

Manufactured by IBW BOILER BUILDERS SINCE 1886

IBW BOILER BUILDERS SINCE 1886

THE INTERNATIONAL BOILER WORKS CO.

890 Spruce St. East Stroudsburg, Pa.

Steel Firebox Heating & Power Boilers · Low & High Pressure Water Tube Package Boilers · International-LaMont Forced Recirculation Generators · ASME Code Pressure Vessels & Welded Products.

NEW CATALOGS

(Continued from page 131)

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

CENTRAL STATION UNITS—A 50-page bulletin, available from Marlo Coil Co., St. Louis, Mo., provides complete information on central station air conditioning units for filtering, washing, heating, cooling, humidifying, dehumidifying and circulating air. Bulletin No. 30 contains photographs, engineering drawings, construction details, dimensions, performance tables and other information on the units, which are available in floor and ceiling types, in 36 sizes from 400 to 40,000 cfm capacity.

Circle **Item 91** on Inquiry Card

TUBE FITTINGS, SPECIALTIES—Available from Eastman Products Corp., Plano, Tex., is a 26-page catalog, No. 57, describing company's lines of plumbing fittings and other specialties. Included are compression and flare-type fittings for copper, brass, and aluminum tubing; gas cocks and connectors; and cutting and flaring tools.

Circle **Item 92** on Inquiry Card

AIR MOVING EQUIPMENT—A 4-page bulletin, describing company's line of centrifugal, general ventilation, and axial airfoil fans; blowers; induced draft fans and roof ventilators, is available from Chicago Blower Corp., Franklin Park, Ill.

Circle **Item 93** on Inquiry Card

TIME SWITCHES—Bulletin GEA-6681, 12 pages, describes Types TS-40, TS-41, and TS-47 time switches manufactured by General Electric Co., Schenectady, N. Y. It contains specifications, design features, and applications.

Circle **Item 94** on Inquiry Card

GASKET REFERENCE CHART—Hydrovalve Co., Brooklyn, N. Y., offers a 17 x 22 inch wall chart showing actual size replacement gaskets for various makes of oil burners, including Delco, Webster, Sunstrand, Detroit, and Tuthill.

Circle **Item 95** on Inquiry Card

BRASS PLUMBING PRODUCTS—W. J. Oberndorf Co., Cleveland, Ohio, announces a general catalog covering its complete line of brass plumbing products. Price list is included.

Circle **Item 96** on Inquiry Card

STEAM TRAP SELECTION— The V. D. Anderson Co., Div. of International Basic Economy Corp., Cleveland, Ohio, announces a 40-page engineering manual for assisting engineering and maintenance people in sizing, specifying, selection and purchase of steam traps and other fluid specialties. Piping details are included.

Circle **Item 97** on Inquiry Card

CONTROLLED DRAFT WATER HEATER— A controlled draft, gas-fired water heater, for medium range commercial use, is subject of 4-page bulletin available from Sellers Engineering Co., Chicago, Ill. Description of immersion firing is given, as well as hourly recovery capacities.

Circle **Item 98** on Inquiry Card

LOW PRESSURE GAS REGULATORS— Low pressure gas regulators for commercial and industrial heating equipment are described with specifications and performance data in 6-page Bulletin No. S-1012, published by Maxitrol Co., Detroit, Mich.

Circle **Item 99** on Inquiry Card

GAGE SAVER—Automatic shut-off valves for overload protection of gages and instruments in hydraulic and pneumatic systems are described in bulletin, from Sprague Engineering Corp., Gardena, Calif., which lists specifications, installation and adjustment details.

Circle **Item 100** on Inquiry Card

UNIT STEAM GENERATORS—The company's house organ, Pyroscope, published periodically by Preferred Utilities Manufacturing Corp., New York, N. Y., is offered. It presents information on developments, products, and applications by this manufacturer of unit steam generators.

Circle **Item 101** on Inquiry Card

DRAINAGE PIPE—A 4-page bulletin available from Southwestern Plastic Pipe Co., a division of Texas Vitrified Pipe Co., Mineral Wells, Tex., describes features and installation methods of Chem-Weld thermoplastic drainage pipe and fittings.

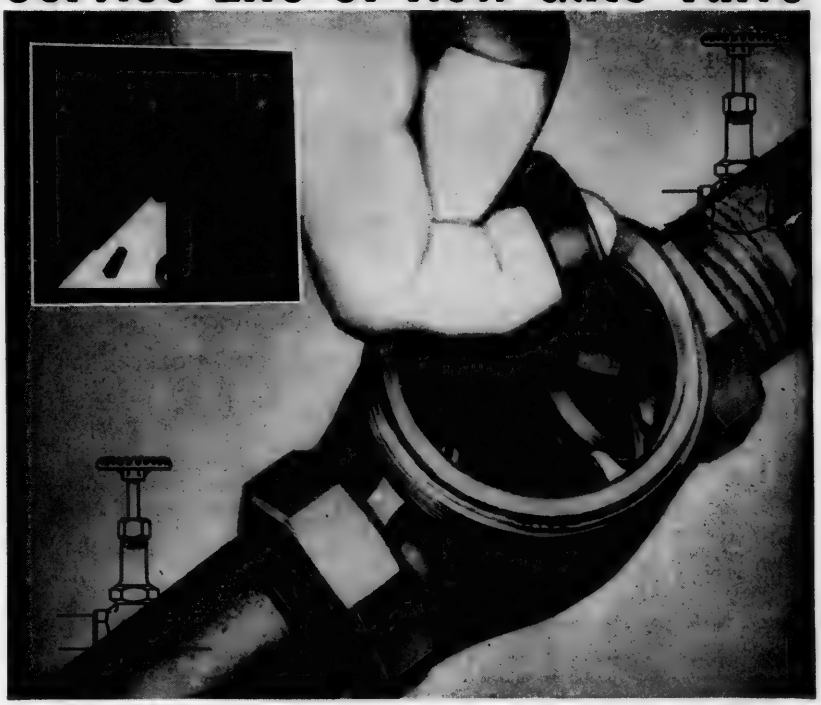
Circle **Item 102** on Inquiry Card

VOLUME WATER HEATING SYSTEMS— A 24-page book, entitled How to Design, Specify, and Buy Large Volume Water Heating Systems, is published by The Cleveland Heater Co., Cleveland, Ohio. Reference contains instructions, tables, and charts to simplify estimating water heating requirements for commercial-type installations.

Circle **Item 103** on Inquiry Card

(Concluded on page 134)

Only 7 to 10 Minutes to Renew Service Life of New Gate Valve



Patented development assures replacement of seat ring while valve remains installed.

Without removing the valve body from the line, you replace the nickel-alloy seat rings in Fairbanks new patented Renewable Seat Ring Gate Valves. In 7 to 10 minutes, from the time the line is shut down until it is put back into operation, you have given a new service life, a new life of dependable tight closure to your valve.

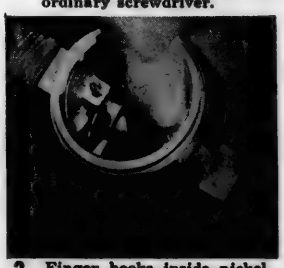
Just 7 to 10 minutes of your maintenance man's time — only 7 to 10 minutes of "downtime" on your steam, water or process piping lines — and you have the equivalent of a new valve in the line. Think of the savings: where once at least one hour, under the most ideal conditions, was required to replace a gate valve in the line, the job is now accomplished in from 7 to 10 minutes.

Field tested for over two years, under all conditions from steam to corrosive liquids, the revolutionary new Fairbanks Renewable Seat Ring Bronze Gate Valve has proven completely satisfactory — absolutely dependable.

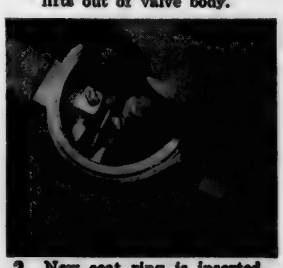
Made with either rising stem or non-rising stem construction in ⅛", ¾", 1", 1¼", 1½" and 2" sizes, the Fairbanks Renewable Seat Ring Bronze Gate Valves are recommended for severe service conditions on 200 lb. steam pressure at 550 degrees F., 400 lb. water, oil or gas pressure — non-shock — lines requiring full flow and subject to frequent operation. Nickel alloy seat rings and wedge make the valves particularly tough and corrosion resistant.

YOURS ON REQUEST: **Illustrated, descriptive folder gives complete information on Fairbanks Renewable Seat Ring Gate Valve with details and specifications. Yours without charge. Write today.**

1. Union Bonnet removed. Retaining screw loosened with ordinary screwdriver.



2. Finger hooks inside nickel alloy seat ring. Seat ring lifts out of valve body.



3. New seat ring is inserted. Retaining screw tightened. Bonnet replaced.

THE Fairbanks COMPANY
393 Lafayette Street, New York 3, N. Y.
Branches:
New York 3 • Boston 10 • Pittsburgh 22 • Rome, Ga.
Valves • Trucks • Casters • Wheels • Dart & "PIC" Unions

installing SIMPLEX

The only completely integrated radiant-acoustical ceiling for

• economy • comfort • efficiency

The environmental control "package" you have been looking for.
This ceiling does the complete job of heating, cooling and ventilating with one medium—air, while providing acoustical insulation, attractive concealment for overhead services and support for recessed lights.

Economy
- Smaller ducts and fans due to a ⅓ saving in air quantities.
- Permanent aluminum ceiling finishes.
- Air diffusers eliminated.
- Rapid, *one trade* installation.

Comfort
By using only air, SIMPLEX combines:
- the speed of response of forced air systems, with
- the superior comfort of radiant heating and cooling.

Saves Space
- Smaller ducts allow shallower plenum spaces. *Saves on building height.*
- All floor space is free for use by building occupant.

Also—no SIMPLEX radiant-acoustical ceiling has ever caused condensation!

Send today for folder with complete specifications, photographs, and details. Simplex Ceiling Corp., 552 W. 52 St., New York 19, N.Y.

SIMPLEX
Ceiling Corp.
552 West 52 St., New York 19, N. Y.
Please send me folder describing the Simplex all air radiant-acoustical ceiling.
Name.....
Firm.....
Address.....
City.....Zone...State.....

NEW CATALOGS

(Concluded from page 133)

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

AIR HANDLING UNIT—A product added to the line of Drayer-Hanson, Div. of National-U. S. Radiator Corp., Los Angeles, Calif., is hot and cold deck high-pressure air handling equipment, detailed in Engineering Data Sheet HCD which is available.

Circle **Item 104** on Inquiry Card

ION EXCHANGE REGENERATION — Ten methods of ion exchange regeneration are discussed in a technical reprint, T-159, available from Graver Water Conditioning Co., New York, N. Y. Article tells how each of the ten methods works, and what controls and equipment are required in each case.

Circle **Item 105** on Inquiry Card

CABINET AIR CONDITIONER—A 20-page booklet, Bulletin 2900, describing a new line of cabinet air conditioners is available from Ilg Electric Ventilating Co., Chicago, Ill. It contains construction details, selection data, arrangement diagrams, and capacity information on seven models.

Circle **Item 106** on Inquiry Card

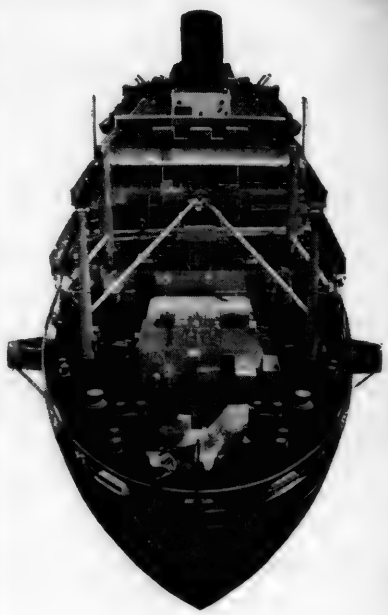
DIRECT-FIRED UNIT HEATERS—A 4-page catalog, No. 287, describing the Luxaire line of direct-fired gas unit heaters, is available from The C. A. Olsen Manufacturing Co., Elyria, Ohio. Included are ratings, specifications, dimensions, and air throw data.

Circle **Item 107** on Inquiry Card

METALLIC WELDED BELLOWS—Bridgeport Thermostat Div., Robertshaw-Fulton Controls Co., Milford, Conn., offers a technical brochure describing Formweld, a metallic welded bellows which has broad applications in the instrumentation, automation, and industrial fields.

Circle **Item 108** on Inquiry Card

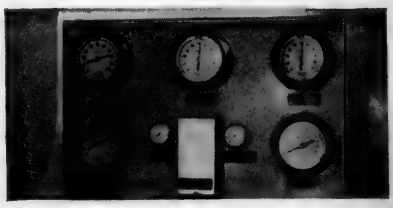
ADEQUATE WATER SYSTEMS—Barnes Manufacturing Co. announces a 16-mm color film, The Company We Keep, a dramatization of water supply requirements. Stressing the importance of planning for future needs in selecting an adequate water system, the 20-min movie also covers product development, engineering and production activities at the company's Mansfield plant. Requests for scheduling should be directed to Advertising Department, Barnes Manufacturing Co., Mansfield, Ohio.



on the

Santa Rosa

Weksler Instruments



for temperature

pressure and humidity

Designed, engineered and manufactured for the finest . . . Weksler Instruments insure that any system is a better system!

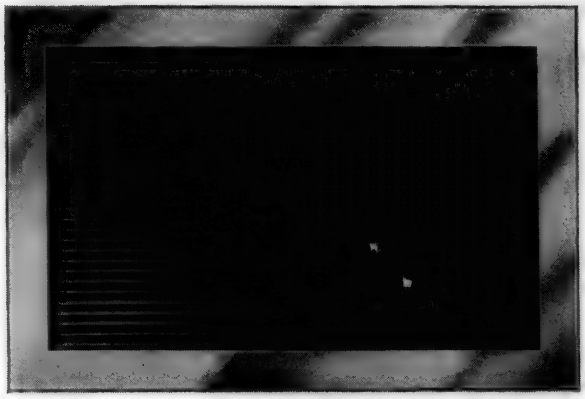
Specify Weksler for your instrument requirements. Write for the Weksler catalogs . . . and use our advisory services without obligation.

Photographs courtesy Newport News Shipbuilding and Dry Dock Company

WEKSLER INSTRUMENTS

WEKSLER INSTRUMENTS CORP
FREEPORT, L. I., NEW YORK

NEW FROM A-J
NO-VISION GRILLE
ALL ALUMINUM



A-7000-B GRILLE

Another first in the field for A-J! New, extruded aluminum A-7000 grille offers exclusive quality features never before available:

Corrosion resistant and rust free.

Minimum weight.

Maximum free area—approximately 70%.

Easily installed in minimum amount of time.

The entire unit reflects quality in every construction detail. By utilizing an auxiliary frame the grille span can be adjusted from 1¼" to 2⅛" depth.

Mill finish is standard unless otherwise specified. Anodized or polished finishes available.

Please write for free catalog.

See our file in SWEET'S—30f/Aa

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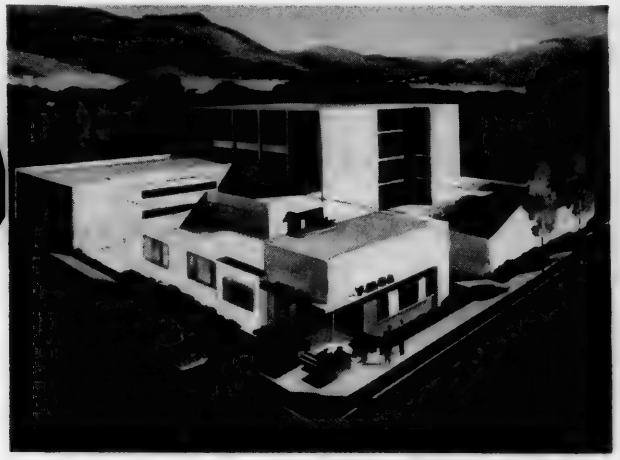
ANOTHER OUTSTANDING USE OF THERMAL EQUIPMENT



This modern structure for the Burbank Y.M.C.A.* includes Thermal forced air heating and ventilating units.

Thermal is proved equipment, specified with confidence that it will produce the utmost in performance and dependability. Write for detailed specifications.

THE THERMAL LINE INCLUDES:

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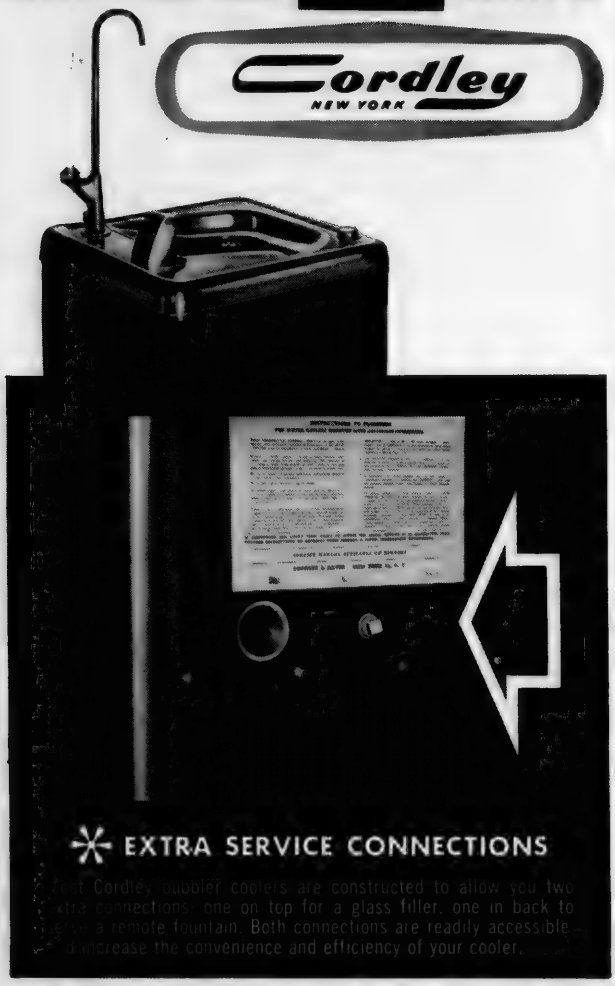
ANOTHER BIG REASON
WHY YOU GET MORE WITH A

Cordley
NEW YORK



✻ EXTRA SERVICE CONNECTIONS

On Cordley bubbler coolers are constructed to allow you two extra connections: one on top for a glass filler, one in back to supply a remote fountain. Both connections are readily accessible, increase the convenience and efficiency of your cooler.

7 Features that spell value

- Dual, mechanically-operated controls—power failure does not affect water flow.
- ✻ Extra service connections—for glass fillers and remote fountains.
- Easy-to-clean pre-cooler—just a few strokes with a bottle brush.
- Uniform-pressure, splash-proof jet—for easy, natural drinking.
- Contamination-proof — all coils bonded externally.
- 7-point thermostat — maintains water at temperature most desired.
- Generous five year Guaranty — your assurance of long-term dependability.

Look for your nearest Cordley Distributor in the Yellow Pages.

There's a Cordley Water Cooler for any drinking water requirement. Write today for complete information on each model... plus data on new Cordley Hot and Cold Water Dispensers.

Ask for Catalog 58.

Cordley Water Coolers Give You *All* The Advantages

NOW AVAILABLE IN THREE DISTINCTIVE LINES

Compact (Just 12" square) Standard Remote

CORDLEY & HAYES
443 Fourth Avenue, New York 16, N. Y.

(Continued from page 122)

pools are specifically excepted and separate proposed standards for them have been issued. Six categories of public swimming pools are delineated, the basis for specific variations from the standards as a whole.

Plans and specifications, with supporting data, according to the standards, must be prepared by a registered engineer or architect and submitted for approval of a state regulatory agency prior to the award of contracts for equipment purchase or construction.

• **NUMEROUS PROVISIONS**—There are forty-four sections to the proposed minimum standards, detailing such items as lifeguard chairs, wall and floor finish, vertical wall depth, overflow gutters, recirculation and filtration, design of the bathhouse, piping, and testing equipment. Pool temperature is set between 75 and 85 deg F. A drawing and schedule of depths and their locations are included.

Chairman of the six-man committee that drew up the standards is Pascal P. Paddock, Pascal P. Paddock Co., Inc., Oklahoma City, Okla. According to Robert S. Greene, executive secretary of NSPI, there are bound to be some controversial elements of these standards, the first to be developed by the industry. However, Mr. Paddock's committee found that after discussion and study, many off-hand criticisms from people within and outside of the industry were withdrawn. The Institute believes, therefore, that the provisions of the standards will stand substantially as written.

An industry-wide organization of professional engineers, manufacturers, builders, and dealers serving the residential and public pools markets, NSPI boasts a membership that includes representatives of 75% of the total swimming pool business volume done in the United States. A special membership is provided for pool owners and operators, as well as public officials.

ELECTRIC SPACE HEATING

boosted by Chicago utility with intensive campaign that includes lowered rates and contractors school.

Approximately fifty Chicago area electrical contractors are enrolled in special courses which are forerunners of schools on electric space heating planned for various locations throughout the distribution system of Commonwealth Edison Company, Chicago, Ill. Courses are part of an active campaign initiated by the utility to promote electrically heated homes.

• **NEW RATE**—The Edison Company has already put into effect a new low rate for residential customers who install permanent electric space heating facilities. For such customers, the rate fixes a charge of 1¾ cents per kwh for all electricity used over 500 kwh per month. This is about 30% below the regular minimum average residential rate of 2½ cents. Accepted by the Illinois Commerce Commission, the new rate is subject to the usual fuel adjustment clause, however. Edison expects that approximately

(Continued on page 138)

30% Savings on Labor Cost
A Permanent Bond
A Better, Neater Job
with
ST. CLAIR
Specially Formulated
INSULATION ADHESIVE

ST. CLAIR Insulation Adhesive specially formulated for bonding insulation material to metal, supersedes pins and clips, wires, screws, and caps. Provides easier, quicker handling. For bonding immediately or up to 45 minutes later.

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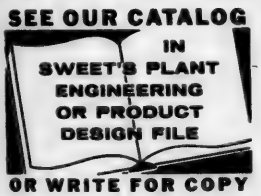
HEATING PROBLEMS?

Get help in a hurry from Chromalox



Four pages of answers to all types of industrial and comfort heating problems. Application information, design features, complete data on sizes, ratings, temperatures to 1200°F. Controls and accessories. Also address listings of Chromalox Sales Engineering Representatives.

Call your Chromalox Man for the answers

For on-the-spot help, pick up the phone and call your Chromalox Representative. He has more than 15,000 standard types, sizes and ratings from which to select the best heater for your job.

For new or existing installations, Chromalox has: the world's most complete line of electric heating . . . the world's largest stock, for immediate shipment . . . personal "no obligation" assistance . . . factory design-engineering service for special applications. Chromalox answers are fast, clean, safe, accurate and economical. Call your Chromalox Man or write today.

2656

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Electric Heat
INDUSTRIAL · COMMERCIAL · RESIDENTIAL
EDWIN L. WIEGAND COMPANY
7588 Thomas Boulevard • Pittsburgh 8, Pa.

Above: View of a portion of 100-plus Aerovent "Model 53" Roof Ventilators installed on a West Coast auto assembly plant. Below: Closeup of a single Model 53 "low-level" unit. Standard and special-purpose units available in sizes 12" to 72" for capacities to 93,500 CFM. 3 types.

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Aerovent fans are rated in accordance with the standard test code for centrifugal and axial fans and conform with U.S.D.C. Comm. Std. CS178-51.

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FAN COMPANY, INC.
ASH and BRANDT STS. • PIQUA, OHIO

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HOT AND COLD DECK
LING UNITS HAVE
ERATION ISOLATION!

STANDARD MODELS 5,000 TO 25,000 CFM. UP TO 8" TOTAL STATIC PRESSURE. HIGH PRESSURE CONSTRUCTION. CIRCULAR DISCHARGE PLENUM ELIMINATES BREATHING. DUAL FORWARD-CURVE FANS; BACKWARDLY-INCLINED, OPTIONAL. DIFFUSERS FOR EVEN AIR DISTRIBUTION. OPTION HORIZONTAL/VERTICAL DISCHARGE. PROMPT DELIVERY. MUCH MORE!

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DIVISION OF NATIONAL-U.S. RADIATOR CORP
3301 MEDFORD STREET
LOS ANGELES 63, CALIFORNIA
CABLE: CLINCONI LOS ANGELES

(Continued from page 136)

500 houses and apartments in the company's service area will be using electricity exclusively for heating this winter. Both direct resistance or radiant heating, and the heat pump are included in this category.

• **TEACH HEAT LOSS ESTIMATING**—According to the utility, its courses are being offered to acquaint local electrical contractors with the growing electric space heating market in northern Illinois. It emphasizes a practical system for estimating heating capacities and operating costs in home and apartment installations. The present course is divided into six weekly sessions of two hours each. Subjects include the fundamentals of electric heating; insulation requirements; calculations of heat loss and operating costs; discussions of equipment; and suggestions for promotion of electric heating.

Electric heating today costs more than conventional installations, the utility admits. However, it foresees a period of rising fossil-fuel costs with a holding of the line on electric production costs because of continuing technical advances.

Pegboard at University of Missouri called a universal operating display board, will help students in university's first course in automatic control this semester to grade themselves automatically. Designed by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., especially for classroom use, it has a variety of peg-mountable temperature control devices with color-coded wires and snap-on connectors to make it easy for students to set up a heating and air conditioning control system and then simulate its operation. In case of error in calculation, a red indicating light glows. If the set-up is properly functional, other lights can be monitored to show how the various components of a comfort system function during a heating or air conditioning cycle. Here Robert Michelson, Honeywell's manager for Industry-Education operations, is shown pegging into place a unit of a typical control system set-up.

(News of the Month concluded on page 140)

THE **weil** TVC

New *Condensate Pumps*

Features:
Low speed (1750 RPM) TVC pumps are easily installed in areas where space is important. Their compact cast iron receiver and sturdy pumping unit assure a trouble-free installation.

Dimensions:
26 gallon cast iron receiver for single or duplex units: Diameter 25"; height of return above floor 10½"; height of unit 36" max.

Installation:
Simple installation: one return connection, one discharge connection. Unit is completely assembled at the factory. Send for Bulletin TVC-300.

Send for Bulletin TVC-300

See Catalog in 1958 Sweet's and 1958 Domestic Eng. Cat. Dir.

Available from Jobbers Stocks!

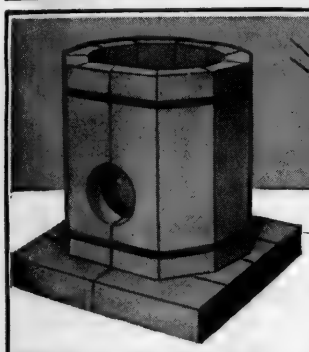
TVC PUMPS now available in capacities from 750 to 15,000 sq. ft. E.D.R.

The three sizes of TVC receivers now offer a complete line of low pressure system condensate pumps to fit all requirements. The LOW RETURN CONNECTION and LOW SPEED — 1750 R.P.M., coupled with the built-in durability, operating efficiency and low cost of these pumps guarantee a satisfactory and trouble free installation. This pump provides gravity drainage for low heating units.

Specify and install a **weil** TVC Pump.

Built for ONE MILLION STARTS . . . without attention

1516 North Fremont Street • Chicago 22, Illinois



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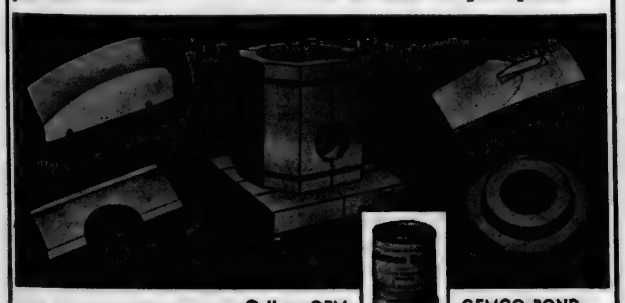
COMBUSTION CHAMBERS

GEM Combustion Chambers are engineered refractories built for performance and designed for easy, fast installation . . . highest combustion efficiency for high or low-pressure burners.

ENGINEERED TO YOUR REQUIREMENTS

. . . GEM engineers are at your service for special designs . . . developing new units or redesigning to reduce assembly costs. Send us your prints.



GEM — Call on GEM Engineers for your Refractory Shapes.

GEMCO BOND refractory cement insures maximum bonding strength.

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low-cost
HEAT
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with
easy-to-install
ZONVALVE

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Now — the comfort of multiple-zone heating at a fraction of the former cost. ZONVALVE, new thermostatically-controlled motorized valve, replaces ordinary radiator valve *without plumbing change.* On new installations, ZONVALVES can be used on radiators or branch lines.

ZONVALVES are made in all standard pipe and tubing sizes. *Low wiring cost* — because motor operator is low voltage. All ZONVALVES equipped with auxiliary switch to start burner or circulator when open.

ZONVALVE is designed for steam and hot water systems. *Unconditionally guaranteed.* Ideal for private homes, factories, office buildings, hotels and motels.

for details write to **HEAT-TIMER CORP.** DEPT. D-8
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VELOMETER

A simple, direct reading on the Alnor Velometer gives you instant measurement of actual air delivery in any distribution system. This fast, precise method eliminates the time and money wasted in trial-and-error balancing...the profit-eating call-backs so often necessary with other less precise measurements.

The Velometer is the only instantaneous, direct reading air velocity meter—accurate in all ranges, from high to low... compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

First Choice of Industry

Take the recommendation of every major manufacturer of air diffusers and leading contractors—get an Alnor Velometer. You'll save time and money on the next installation you balance.

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Please send Velometer Bulletin 2448-G.

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Company.....

Address.....

City.....Zone.....State.....

(Concluded from page 138)

CLEVELAND APPROVES PLASTIC PIPE

for street-to-house water service. The first major city to do so, it follows several state approvals.

Amendment of its local building code by the city of Cleveland, Ohio, to permit the use of plastic pipe for street-to-house service lines follows similar and more limited approvals recently won for plastic pipe in several state building codes. Cleveland is the first major city to grant approval, however.

Arkansas has amended its plumbing code to allow the use of plastic pipe for water service from the utility main to the building line. Plastic pipe has been included in the Kentucky plumbing code for specific use in water systems. The Florida State Board of Health has issued a memorandum regarding the use of flexible polyethylene pipe in public swimming pools and water systems. California's Public Utility Commission has permitted the use of plastic pipe in privately owned public water systems since July, 1956.

• **NSF ACTIVE**—Credit for much of the increased acceptance of plastic pipe by governmental agencies and the public is claimed by the National Sanitation Foundation, whose testing and labeling program followed a four-year testing period at the Foundation's headquarters at the University of Michigan School of Public Health. In return for compliance with NSF standards, manufacturers of plastic pipe are required to identify their pipe at least once every 18 inches with the NSF seal of approval. At the same time they are granted permission to use the NSF seal of approval in their advertising, technical data sheets, and other literature.

COAL PIPELINE

delivers in excess of design capacity during test. Utility will use 18 million tons in next 15 years.

Consolidation Coal Company's 108-mile coal pipeline, operating between Georgetown and Eastlake, Ohio, is in full operation. In a recent 30 day period, the line operated in excess of its designed capacity. Cleveland Electric Illuminating Company will purchase 18 million tons of pipeline coal over the next 15 years for its Eastlake, Ohio, power station.

A joint undertaking of the coal company and the utility, the pipeline is said to be the longest solids-transporting pipeline in the world.

The coal is transported as slurry comprising finely ground coal and water in equal proportions. The line measures 10½ inches in diameter and is buried beneath the frostline. At the preparation plant in Georgetown the coal is cleaned, crushed to a prescribed size, and mixed with water. The slurry is sent through the line by three pumping stations, one at the initial stage of preparation and the other two appropriately spaced along the 108-mile route. Arriving in Eastlake, the water and coal are separated and the coal dried for use in the utility furnaces. The separated clear water is discharged into Lake Erie. Because of filtration and clarifying, this water is purer than the lake water it joins.

Airsan Viro Crimp
HIGH VELOCITY AIR FILTERS

VIRO CRIMP MEDIA
has special Hemmed Edges for strength and safe, easy handling. No Cuts! No Scratches! No Filter surface damage.

- MAXIMUM EFFICIENCY (288 — 510 FPM)
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- NO DIRECT AIR PASSAGE
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Also Available . . .
Low Velocity and Grease Filters.
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A few distributorships available.
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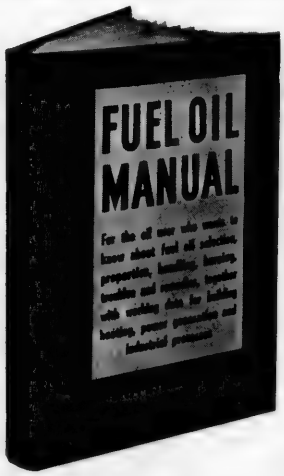

Here is a book that will give you a comprehensive picture of the characteristics and uses of every type and grade of fuel oil. The author explains the meaning of each oily property, and shows how this information is applied to the selection, handling and burning of fuel oil. Impurities and how they effect combustion are described fully, and a special chapter describes fuel oil additives and how they are used. Another chapter lists troubles which may be encountered in using fuel oils, and shows the correct remedy to apply in each case. Technical language is avoided wherever possible and all terms are fully explained.

160 Pages **$4.50** 34 Tables

In Canada or overseas, $5.50

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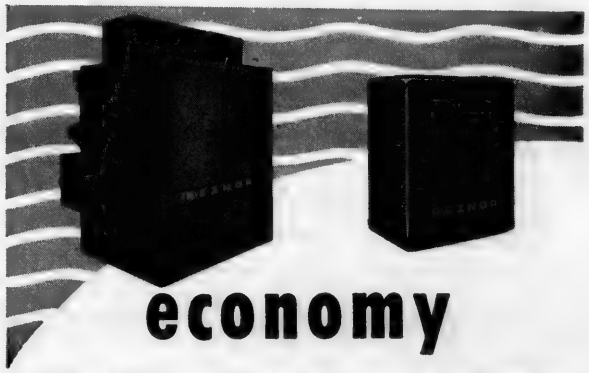


economy

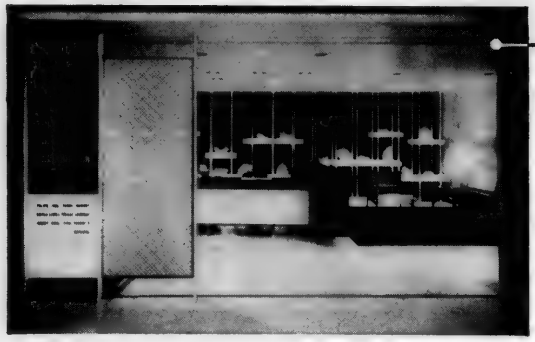
BTU for BTU, Reznor gas unit heaters cost much less than most other types of heating equipment. Installation offers additional savings . . . it requires only suspension, gas and electrical connections, and simple venting. And Reznor suspended units help you hold down total cost per usable square foot . . . because they occupy absolutely no valuable floor space.

ECONOMY makes these completely-automatic packaged units the ideal way to heat a wide variety of commercial and industrial buildings. Ask your Reznor distributor for the complete story or write for your free copy of "Modern Heating"

Reznor under "Heaters-Unit" in the Yellow Pages

REZNOR
WORLD'S LARGEST SELLING DIRECT FIRED
UNIT HEATERS

Reznor Manufacturing Company, 64 Union Street, Mercer, Pa.



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Maria Bergson Associates

STRIPLINE

Distinctive SLOT TYPE Diffusers

Look around . . . you'll see STRIPLINE by AGITAIR everywhere. And no wonder. STRIPLINE combines the best features of both slots and efficient air diffusers to provide equalized air flow throughout its entire length.

Slender, inconspicuous, practical and versatile . . . STRIPLINE slot diffusers can be located in walls, ceilings, coves, moulds, window reveals, stools . . . yes anywhere to suit interior design.

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high velocity units • punkah louvers
air diffusers • filters • exhausters

Sold exclusively by representatives for:

AIR DEVICES INC.

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Type H

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

BUILDINGS FOR RESEARCH

A selection of articles on new research buildings, that first appeared in issues of Architectural Record, was made by the editors of that magazine, and is published in book form with the title, Buildings for Research.

Major research building developments since 1950 are described. The first section features a broad discussion of general laboratory planning and design objectives. This is followed by sections on specific research fields.

Buildings for Research, by the editors of Architectural Record. Cloth bound, 8½ x 11½ inches, 224 pages. Published by F. W. Dodge Corp., 119 W. 40 St., New York, N. Y. Price, $9.50.

• • •

National Fire Protection Association—Two booklets, each selling for 50 cents, have been issued by NFPA. No. 90A is the 1958 Standard for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type. NFPA No. 204-P is a Tentative Guide for Emergency Smoke and Heat Venting in Industrial Properties. Both are illustrated. National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

Steel Butt-Welding Fittings—All dimensions, tolerances and markings for wrought and cast carbon, and alloy steel welding fittings known as American Standard Steel Butt-Welding Fittings are covered in ASA B16.9-1958. This publication may be obtained from The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.50.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available

APPLIED METEOROLOGY CONFERENCE—Second National Conference on Applied Meteorology: Engineering, co-sponsored by The American Meteorological Society and The American Society of Civil Engineers, in cooperation with The University of Michigan, at Rackham Building, University of Michigan Campus, Ann Arbor, Mich. K. C. Spengler, executive secretary of the AMS, 3 Joy St., Boston 8, Mass. ..... **SEPTEMBER 9-11, 1958.**

INSTRUMENT-AUTOMATION EXHIBIT — Instrument-Automation Conference and Exhibit, of the Instrument Society of America, at Convention Hall, Philadelphia, Pa. Secretary of the Society, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **SEPTEMBER 15-19, 1958.**

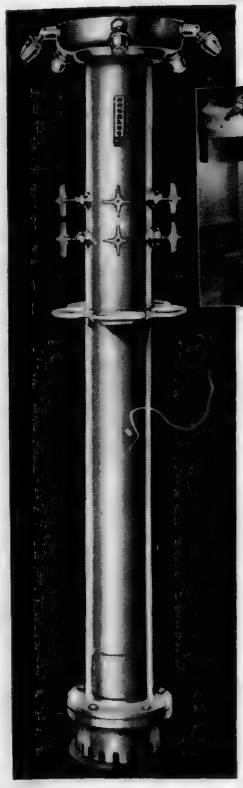
SANITARY ENGINEERING MEETING—Annual meeting of the American Society of Sanitary Engineering, at the Claridge Hotel, Atlantic City, N. J. M. Mercury, secretary of the Society, 4328 Southwestern Ave., Chicago 9, Ill. ..... **SEPTEMBER 20-26, 1958.**

CHEMICAL ENGINEERS MEETING—38th national meeting of the American Institute of Chemical Engineers, at the Hotel Utah, Salt Lake City, Utah. Secretary of the Society, 25 West 45th St., New York 36, N. Y. ..... **SEPTEMBER 21-24, 1958.**

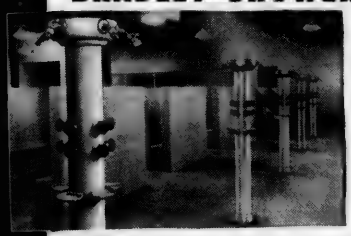
STANDARDS ENGINEERS MEETING—7th annual meeting of the Standards Engineers Society, at the Benjamin Franklin Hotel, Philadelphia, Pa. Secretary of the Society, Box 281, Camden, N. J. ..... **SEPTEMBER 22-24, 1958.**

(Concluded on page 144)

more profits for you!



INSTALL LOWER COST BRADLEY SHOWERS



• Where shower stall separations are not essential, the *Bradley Column Shower* offers the lowest cost bathing facilities. *One* Column provides for *five* bathers, each with control of water supply and temperature. They are used in schools, camps, recreation centers, institutions, factories, etc., etc.

Bradleys can help you get more shower bath business. Write for specifications and installation data, Catalog 5601 . . . BRADLEY WASHFOUNTAIN CO., 2352 W. Michigan St., Milwaukee 1, Wis.

BRADLEY multi-stall showers

Distributed Through Plumbing Wholesalers

FULL "WET-BACK" CONSTRUCTION

SCOTCH TYPE LOW PRESSURE BOILER

ASME

. . . supplies steam and hot water for institutions, commercial and industrial installations

13 SIZES: Steam 5,470 to 42,500 sq. ft. Water 8,750 to 68,000 sq. ft. Working pressures: steam 15 lbs.; water 30 lbs.

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RADIANT HEATING

All you need to know about the design and installation of all types of radiant heating systems.

Step-by-step procedure, general information, design formulas and working data combine to give you the facts you need in designing and installing effective systems. All formulas have been reduced to the simplest terms. Typical problems are solved by the application of the easy-to-use charts and tables—without calculation.

504 Pages $6.00 337 Illustrations

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• architects and engineers can specify this boiler with confidence, assured that all the necessary heat and hot water requirements will be delivered

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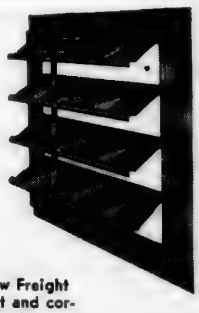

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Shutters of modern design which give you ALL of these features: Lightweight, Full Weather Strip, Low Freight Cost, Easier installation, Concealed Pivot Pins, Rust and corrosion Proof and Natural aluminum finish with fluted frames.

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requires no service—contacts never pit, burn or corrode.
PERMANENT ALNICO MAGNET
links water level with electrical controls; prevents failure of mechanical linkages.
CORROSION-RESISTANT FLOAT
is made of 304 Stainless Steel for long, trouble-free service. Can also be made of special materials for exterme local conditions.
NO-SCALE FLOAT CHAMBER LINER
"flexes" off scale; prevents float "sticking".

Here's "Low Maintenance"

BOILER SAFETY

MAGNETROL

BOILER WATER LEVEL CONTROLS

"Blow-down" the float chamber once-a-shift; inspect the switches once a month—that's all you have to do to keep a Magnetrol in tip-top *safe shape.* It's made that way. The secret is all in the simple magnetic operating principle *as pioneered and perfected by Magnetrol.*

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Please send Catalog Section III with full information about Magnetrol Boiler Water Level Controls.
10

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Address_____

City_____ Zone____ State_____

(Concluded from page 142)

CHEMICAL WORKSHOP—A chemical industry safety workshop, sponsored by the Manufacturing Chemists' Association, in cooperation with the Texas Chemical Council, to be held at the Shamrock Hilton Hotel, Houston, Tex. C. E. Wallace, Manufacturing Chemists Association, Inc., 1625 Eye St., N.W., Washington 6, D. C. ..... **SEPTEMBER 25, 1958.**

ELECTRONICS CONFERENCE—1958 National Electronics Conference, sponsored by the American Institute of Electrical Engineers, Illinois Insitute of Technology, Institute of Radio Engineers, and Northwestern and Illinois Universities, to be held at the Hotel Sherman, Chicago. R. E. Hornacek, Publicity Committee Chairman, Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6, Ill. ..... **OCTOBER 13-15, 1958.**

AGA CONVENTION—Annual convention, American Gas Association, at Convention Hall Auditorium, Atlantic City, N. J. Secretary of the Association, 420 Lexington Ave., New York 17, N. Y. ..... **OCTOBER 13-15, 1958.**

REFRIGERATION WHOLESALERS MEETING—Annual meeting of the Air-Conditioning and Refrigeration Wholesalers, at the Sheraton-Palace Hotel, San Francisco, Calif. Secretary of the Institute, 2607 N. High St., Columbus, Ohio. ..... **OCTOBER 22-24, 1958.**

PUBLIC HEALTH MEETING—86th annual meeting of the American Public Health Association, at Kiel Auditorium, St. Louis, Mo. Schless and Company, 14 W. 55th St., New York 19, N. Y. ..... **OCTOBER 27-31, 1958.**

TECHNICAL WRITERS CONVENTION—Sixth annual convention of the Society of Technical Writers and Editors, Inc., at the Shoreham Hotel, Washington, D. C. G. J. Goodstadt, public relations director of the Society, 11 Riverside Drive, New York 23, N. Y. ..... **NOVEMBER 17-18, 1958.**

PLASTICS INDUSTRY EXPOSITION—Eighth national plastics exposition of the Society of the Plastics Industry, Inc., at International Amphitheatre, Chicago, Ill., to be held concurrently with the SPI annual national conference, Morrison Hotel, Chicago. Secretary of the Society, 250 Park Ave., New York 17, N. Y. ..... **NOVEMBER 17-21, 1958.**

AIR POLLUTION CONFERENCE—The National Conference on Air Pollution, at Sheraton-Park Hotel, Washington, D. C. Surgeon General, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C. .... **NOVEMBER 18-20, 1958.**

POWER SHOW—23rd National Exposition of Power and Mechanical Engineering, under the auspices of The American Society of Mechanical Engineers, in conjunction with the Society's 78th annual meeting, at the Coliseum, New York. E. K. Stevens, president, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. ..... **DECEMBER 1-5, 1958.**

EXPOSITION AND ASHAE CONVENTION—65th annual meeting, American Society of Heating and Air-Conditioning Engineers (Jan. 26-29, 1959) and 14th International Heating and Air Conditioning Exposition, Philadelphia, Pa. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. ... **JANUARY 26-30, 1959.**

WESTERN METAL EXPOSITION—Eleventh Western Metal Exposition and Congress, of the American Society for Metals, at the Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif. R. Y. Bayless, assistant secretary of the Society, 7301 Euclid Ave., Cleveland 3, Ohio. ..... **MARCH 16-20, 1959.**

GAMA MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at the Americana Hotel, Bal Harbour, Fla. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. ..... **APRIL 1-3, 1959.**

ASRE CONVENTION—Convention of the American Society of Refrigerating Engineers, at the Hotel Traymore, Atlantic City, N. J. R. C. Cross, secretary of the Society, 234 Fifth Ave., New York 1, N. Y. ..... **OCTOBER 30-NOVEMBER 1, 1959.**

ARI EXPOSITION—11th Exposition of the Air-Conditioning and Refrigeration Industry at Convention Hall, Atlantic City, N. J. Geo. S. Jones, Jr., managing director of Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C. ..... **NOVEMBER 2-5, 1959.**

ASHAE MEETING—66th annual meeting of the American Society of Heating and Air-Conditioning Engineers, and the 2nd Southwest Heating and Air-Conditioning Exposition, sponsored by ASHAE, in Dallas, Tex. The meeting will be at the Baker and Adolphus Hotels, and the Exposition in the Memorial Auditorium. Secretary of the Society, 62 Worth St., New York 13, N. Y. .. **FEBRUARY 1-4, 1960.**

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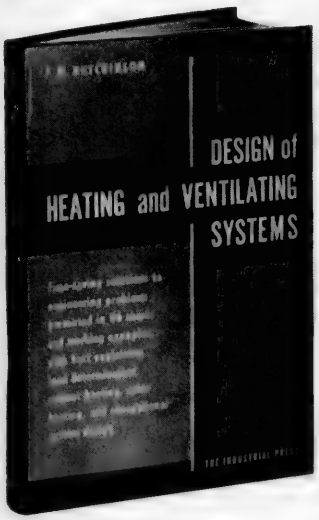

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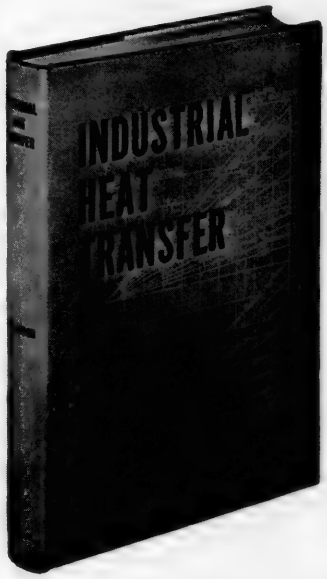

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TEMPERATURE REGULATORS ..... offer the surest way to keep temperatures from getting out of control. Self-contained and completely automatic regulators control liquid temperatures with an accuracy never before achieved. Literature is available.
Inside Front Cover — Item 200

STEAM HUMIDIFIERS ..... offer automatic and accurate control, low initial cost, and very low maintenance. Join others who have solved dry air problems with bulletin that is offered.
Page 1 — Item 201

CONDENSATE PUMPS ..... featuring mechanical shaft seals are available from the manufacturer. Bulletins describe complete line, including single and duplex units, turbine units, vacuum units, etc.
Page 2 — Item 202

CONVERTORS, HEAT EXCHANGERS.. for hot water heating systems are described with much useful application information in two catalogs which are available from the manufacturer of this equipment.
Page 5 — Item 203

THE BEST INSULATORS ..... against heat, cold, and vapor in building spaces are metals. A manual, "Heat Flow by Radiation," is offered.
Page 7 — Item 204

HYDRONIC EQUIPMENT ..... in the world's most complete line of products is offered by this manufacturer under the emblem that has become known as the symbol of quality. Information is available.
Page 9 — Item 205

ANOTHER FUTURE ..... of faultless service is assured in Philadelphia's 18-story Transportation Building by means of the manufacturer's diaphragm-type flush valve. Information is available.
Page 11 — Item 206

CAPILLARY ASSEMBLIES ..... incorporating this manufacturer's restrictor tubes are used by Fedders-Quigan Corp. Qualities include uniform performance, due to uniform, clean bore, and easy bending, without fracture. Information and Air-Flow Slide Rule Calculator are offered.
Page 13 — Item 207

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement.

NOTE: All advertisements are digested here except those received too late for inclusion. The Index of Advertisers lists all the advertisements in this issue.

Use the postcard below for catalogs, new equipment and materials, as well as Ad-Digest items.

REMOTE AIR COOLED CONDENSER.. requires only 1/3 of the refrigerant charge used by competitive models. This means smaller receivers and minimum loss if system charge is lost. Information is available.
Page 15 — Item 208

INDUSTRIAL SPACE HEATERS..... from this manufacturer are backed by a worldwide organization. Should the need arise, service for both installation and maintenance is as close as your telephone. Bulletin is available.
Pages 16-17 — Item 209

UNIT AIR CONDITIONERS..... of the fan-coil type are designed, engineered and manufactured to meet the professional requirements of each member of the building team. Information is available.
Pages 18-19 — Item 210

BOILER-BURNER PACKAGES ..... in 36 sizes span a full range of fuels. Forced draft eliminates high stacks; factory assembling means only 5 simple field connections. Complete facts are offered.
Page 20 — Item 211

A SMOOTHER PATH ..... for hot or cold air is provided with these die-stamped two-piece 90-deg elbows. They are ideal for high velocity systems. Engineering data is offered.
Page 21 — Item 212

COOLING WITH GAS ..... provides years of trouble-free comfort when the manufacturer's gas absorptive cooler is specified. This cooling can put commercial and industrial heating plants on a year around paying basis. Information is available.
Pages 22-23 — Item 213

INQUIRY CARD

Circle below item numbers on which you wish catalogs or further information

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PLEASE PRINT — Sept. 11-58

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Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....**Zone** ....**State** .....

This card is void after Dec. 1, 1958

LIFETIME SERVICE VALVES .....
from this manufacturer were selected for the $17-million aluminum and glass building erected by Cleveland Electric Illuminating Co. Information is available.
Page 24 Item 214

THE EXACT UNIT HEATER .....
for the job, be it gas, steam, or hot water heat, is available from this manufacturer. Fast delivery from local stock is a feature. Information is available.
Page 25 Item 215

AIR MOVING EQUIPMENT .....
is designed for low initial cost and continuous, trouble-free performance. Each unit is completely built by the company. Catalogs are available.
Page 28 Item 216

CENTRALIZED CONTROL .....
of air conditioning saves manpower and assures ideal working environment at North American Aviation's busy new headquarters. Information is available.
Page 29 Item 217

INDUSTRIAL AIR DIFFUSER .....
delivers draft-free air at less than 2½ cents per cfm. Besides comfort for workers, unit gives consistently low rates of air motion which will not interfere with production. Information is available.
Page 30 Item 218

UNIT HEATERS FOR EVERY NEED...
have modern styling to blend with surroundings. Available is wide range of sizes, steam or hot water, for low-cost heating with extra efficiency of rippled fin oil. Information is offered.
Page 31 Item 219

ELECTRIC MOTOR DATA SHEET .....
discusses repulsion-start induction motors for starting heavy loads with low current; capacitor-start motors for normal starting applications and split phase motors in fractional sizes for low starting torque requirements. Bulletins available.
Insert bet. Pages 33-34 Item 220

RELIABLE VENTILATION .....
in a package is offered by the manufacturer's belted vent sets. Sets are equally adaptable to indoor or outdoor installations. Bulletin is available.
Page 35 Item 221

HEAT PUMP SYSTEMS .....
are factory-tailored to meet commercial and industrial requirements. Company's chart, reproduced in ad, aids determination of preselected components that provide exactly the proper range of heating and cooling capacity. Details are available.
Pages 36-37 Item 222

DIFFUSER SELECTION MANUAL .....
is offered by company that pioneered development of all-air high velocity systems with over 500 installations on American continent. Manual contains complete information on architectural and engineering advantages.
Page 38 Item 223

FORCED DRAFT OIL BURNER .....
fires heavy oil with light oil dependability. Modulation over a wide range is provided. Burner is available as part of boiler-burner unit or as conversion burner. Information is available.
Page 39 Item 224

AIR CONDITIONING PUMPS .....
from this manufacturer are engineered with one idea: To make equipment designers' jobs easier. Choice of pumps, sealless or with mechanical seal, is offered. Information is available.
Page 40 Item 225

FIVE REFRIGERANT COMPRESSORS..
supply the refrigerant for chilled water for air conditioning the new Fulton Federal Building at Atlanta. Company's system, fully automatic, said to be highly satisfactory in every respect. Information available.
Page 41 Item 226

"OFF-THE-SHELF" DELIVERY .....
is offered with the company's competitively priced unit heaters. Both vertical and horizontal designs are available. Information is available.
Page 42 Item 227

CUSHIONED BALL BEARINGS .....
permit simpler design and construction of air conditioning systems. The grommet that encases each bearing is made of electric-current-conducting rubber which means: no metallic grounding springs or clips are needed to run off static electricity; possible source of noise is eliminated. New bulletin available.
Page 43 Item 228

SEAMLESS STEEL PIPE .....
will reimburse in outstanding service many times the cost. Over 11,000 ft of the manufacturer's steel pipe was used in plumbing and fire protection systems of a St. Louis federal housing project. Information is available.
Page 44 Item 229

DUCT LINER .....
made exclusively of strong textile-type glass fibers will not pull apart under high vibration and high wind velocity conditions. Information is available.
Page 45 Item 230

UNIT VENTILATOR CONTROL .....
through the manufacturer's modern pneumatic system prevents overheated classrooms and cold drafts, and insures lowest cost maintenance. Information is available.
Pages 46-47 Item 231

PACKAGED WATER CHILLER .....
offers more cooling in 20% less floor space. Factory assembled units install anywhere in the building. Catalog is available.
Page 48 Item 232

MOTOR STARTERS .....
for air conditioning service offer rugged simplicity. Simple, durable contactors assure continuous service. Information is available.
Page 49 Item 233

EXTRUDED ALUMINUM LOUVERS....
are electrically operated, efficient, attractive, reliable and economical. Each unit carries two years' guarantee. Information is available.
Page 50 Item 234

BIG GENERAL PURPOSE FANS.....
provide big performance for process and ventilating applications. Self-contained, in 12 sizes, in four types. Bulletin available.
Page 51 Item 235

QUIET, EFFICIENT FANS .....
are offered for any process or comfort job. Accurate ratings, rugged construction assure dependable operation. Write on your letterhead for bulletins detailed in ad.
Page 107 Item 236

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AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

DOUBLE DUCT CONTROL .....
mixes hot and cold air and reduces it to conventional velocity at minimum noise levels. Self-contained constant volume control simplifies stabilization of high velocity systems. Information is available.
Page 109 Item 237

EMPLOYEE WELL-BEING .....
and efficient manufacture are both aided by this manufacturer's air conditioning equipment at the new Avon cosmetics plant in Morton Grove, Ill. Information is available.
Page 111 Item 238

COMPLETE-LINE CONDITIONING .....
enables custom quoting on every job. Company is signing on a select group of new air conditioning dealers. Complete air conditioning story offered.
Page 116 Item 239

FIBER GLASS FILTERS .....
are designed for safety without sacrificing strength. Chipboard grille eliminates cuts and scratches. Information is available.
Page 117 Item 240

ECONOMICAL COOLING .....
is trouble free, thanks to our gas-fired absorption refrigeration. This is the comment of spokesman for National Aluminate Corp., whose heating system is now on the year-round paying basis. Information is available.
Page 119 Item 241

FACTORY-ASSEMBLED UNITS .....
provide more economical air conditioning than field assembled systems, as indicated by this case history describing zone-by-zone air conditioning in the Dallas Home Furnishing Mart. Details are offered.
Page 121 Item 242

GUARANTEED FREEDOM .....
from flange and fitting failure is offered by this manufacturer. Modern scientific methods prevent all but the perfect flanges and fittings from reaching your job. Information is available.
Page 123 Item 243

FLEXIBLE HOSE .....
is adaptable for all kinds of fume and dust control and ventilation uses. It is durable, lightweight, and easy to install. Information is available.
Page 124 Item 244

LOWER-PRICED RECORDERS .....
for humidity and temperature measurement are offered by this manufacturer. Accuracy and performance are guaranteed unconditionally for a full year. Information is available.
Page 124 Item 245

CENTRIFUGAL WATER COOLING ....
system from this manufacturer is more nearly hermetically sealed than any other centrifugal system. Number of parts cut, wide range of capacities offered, all with single stage simplicity. Information is available.
Page 125 Item 246

ENGINEERED FILTERS .....
for air conditioning and ventilating equipment, machines, compressors, or any device using air or liquid are available from this company. All-line catalog is offered.
Page 126 Item 247

AIR ENGINEERING BOOKLET .....
offered by air conditioning manufacturer whose systems give precise regulation of air temperature and moisture for processing, product drying, packing, storing, low temperature conversion, testing, and research. Components include evaporative heat exchangers, after coolers, condensers, air conditioners, and coolers.
Page 126 Item 248

BURNERS FOR GAS OR OIL .....
combine low installation and maintenance costs with added years of dependable service. Information is available.
Page 127 Item 249

FLEXIBLE DUCT CONNECTION .....
is prefabricated—simply pull out desired length from dispenser-type carton, roll into round duct or form into square duct. Information available.
Page 127 Item 250

NEW SUPPLY PUMP EQUIPMENT.....
to handle No. 5 and No. 6 furnace oils is offered. Direct drive units are motor driven at 900 rpm optimum speed. Capacities and pressures of belt driven sets can be varied. Additional information offered.
Page 127 Item 251

ALL TYPES OF VENTILATION .....
problems are solved in efficient manner by complete line, certified performance, and competitive pricing of manufacturer's air moving equipment. Catalog is available.
Page 128 Item 252

GENERATORS FOR STEAM .....
as well as hot water are offered by this manufacturer to save costs, time, and space in your plans for new or remodeling construction. Information is offered.
Page 129 Item 253

EXPANSION JOINTS .....
from this manufacturer may be serviced in the line under full steam pressure. Costly shutdowns are eliminated. Catalog is available.
Page 129 Item 254

HEAVY DUTY BOILERS .....
are listed in manufacturer's line for every steam or water heating application up to 1.8 million Btu per hr output. Information is available.
Page 130 Item 255

END-SUCTION CENTRIFUGAL PUMP..
is ideally suited for air conditioning service. Four-piece liquid and assembly permits easy service and maintenance. Capacities range to 1000 gpm. Bulletins are available.
Page 131 Item 256

FIRST FULLY AUTOMATIC .....
packaged unit for burning low cost bituminous coal cleanly and efficiently is offered. Unit is complete with combustion controls, automatic coal feed, and ash removal system. Bulletin is available.
Page 132 Item 257

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

INQUIRY CARD

Circle below item numbers on which you wish catalogs or further information

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
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67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
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266	267	268	269	270	271	272	273	274	275	276	277	278	279	280							

PLEASE PRINT Sept. H-58

This service available only to U.S. and Canadian readers.

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....**Zone** ....**State** .....

Ad-Digest

LESS THAN TEN MINUTES .....
is required to renew service life of company's Renewable Seat Ring Gate Valves by means of replaceable nickel-alloy seat rings. Complete information is offered.
Page 133 Item 258

RADIANT-ACOUSTICAL CEILINGS ....
provide complete integration for economy, comfort, and efficiency. Never caused condensation! Folder describes them.
Page 134 Item 259

ON THE SANTA ROSA .....
instruments from this manufacturer measure temperature, pressure and humidity. Catalogs and advisory services are offered.
Page 134 Item 260

NO-VISION GRILLE .....
of extruded aluminum offers quality features including minimum weight, maximum free area, and corrosion resistance. Catalog is offered.
Page 135 Item 261

FORCED AIR HEATING .....
and ventilating units from this manufacturer were applied in a modern structure for the Burbank, Calif., Y. M. C. A. Detailed specifications are available.
Page 135 Item 262

EXTRA SERVICE CONNECTIONS .....
is one of seven features that spell extra value on these bubbler coolers. Coolers are available in three distinctive lines. Catalog is offered.
Page 136 Item 263

INSULATION ADHESIVE .....
is specially formulated, and offers 30% savings on labor cost, a permanent bond, and a neater job. Catalog sheet and sample are available.
Page 137 Item 264

COMFORT HEATING PROBLEMS .....
as well as industrial heating problems can be solved in a hurry by means of the manufacturer's catalog of electric heating equipment. It is available.
Page 137 Item 265

ROOF VENTILATORS .....
from this manufacturer fit every need. Over a hundred were installed on a West Coast auto assembly plant. Bulletin is available.
Page 137 Item 266

NEW AIR HANDLING UNITS .....
are high pressure hot and cold deck models with internal vibration isolation, available up to 25,000 cfm, 8 inches static pressure, with prompt delivery. Circular discharge plenum eliminates breathing. Information available.
Page 138 Item 267

COMBUSTION CHAMBERS .....
utilizing the manufacturer's engineered refractories are available in special shapes to meet all individual requirements and specifications. Information is available.
Page 139 Item 268

LOW-COST HEAT ZONING .....
is available with metering valve which provides the comfort of multiple zone heating at a fraction of the former cost. For steam or hot water, they are unconditionally guaranteed. Details available.
Page 139 Item 269

CAST IRON RECEIVERS .....
in three sizes now offer a complete line of low pressure system condensate pumps to fit all rquirements. Features include low return connection, low speed and long life. Bulletin is available.
Page 139 Item 270

DIRECT READING VELOMETER .....
measures actual air delivery. Simple, direct reading gives instant measurement in any distribution system. Device is portable, easy to understand and to use. Bulletin is available.
Page 140 Item 271

HIGH VELOCITY AIR FILTERS .....
feature high efficiency, minimum resistance, no direct air passage and large dust holding capacity. Catalog is available.
Page 141 Item 272

GAS UNIT HEATERS .....
cost much less, Btu for Btu, than most other types of heating equipment. Completely automatic packaged units occupy absolutely no valuable floor space. Booklet, entitled "Modern Heating", is offered.
Page 141 Item 273

SLOT-TYPE DIFFUSERS .....
combine the best features of both slots and efficient air diffusers to provide equalized air flow throughout entire length. Diffusers can be located anywhere to suit interior design. Catalog is available.
Page 142 Item 274

COLUMN SHOWER .....
offers the lowest cost bathing facilities where shower stall separations are not essential. One column provides five bathers with control of water supply and temperature. Catalog is offered.
Page 143 Item 275

EXTRUDED ALUMINUM SHUTTERS...
are of modern design, light weight, fully weather-stripped, easier to install, and are rust and corrosion proof. Complete specifications available.
Page 143 Item 276

LOW PRESSURE BOILER .....
of the Scotch type with full "wet back" construction supplies steam and hot water for institutions, commercial and industrial installations. Literature is available.
Page 143 Item 277

BOILER WATER LEVEL CONTROLS...
are beleved to be the safest as well as simplest devices available. Operating life is almost unlimited. Catalog is available.
Page 144 Item 278

LOW INSTALLATION COST .....
is a feature of the company's valves and specialties, including indicators, filter driers, and strainers. Catalogs describing the complete line are available.
Inside Back Cover Item 279

NEW ELECTRIC FLOW SWITCHES....
are applicable wherever it is important to know if a flow of liquid starts or stops. Dependable and moderately priced, they make or break electric circuits to control alarm, motor, burner, metering device, etc. Bulletin available details applications.
Back Cover Item 280

Postage Will be paid by Addressee

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BUSINESS REPLY CARD

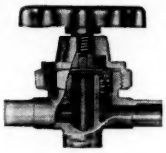
FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

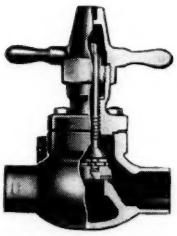


"Golden Bantam" Packless Valve—Type 516

A small packless line shut-off valve with ¼″ thru ⅝″ flare, O.D.S. or extended end solder connections. Also "Blue Bantam" and "Standard" Balanced-Action packless line shut-off valves with ¼″ thru ⅝″ Fl. and ¼″ thru 1⅛″ O.D.S. size connections.

Cross-Vu® Hermetic Seal Liquid Indicator—Type LI-16

Brass indicator with glass fused directly to metal body. Maximum working pressure 500 P.S.I. Connection sizes: ¼″ thru ⅝″ M.Fl., M.Fl. x F.Fl. or with extended ends and solder connections.



Wing Cap Packed Valves—Type 203

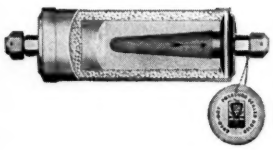
The standard of the industry. Bronze alloy with O.D.S. connections in sizes ⅜″ thru 4⅛″ (Globe) and ⅞″ thru 3⅛″ (Angle). Also semi-steel with ½″ thru 2½″ F.P.T. connections and semi-steel flanged type globe and angle valves with brass O.D.S. or steel butt-weld adapters, and one piece socket weld or F.P.T. flanges in a wide range of sizes from 1″ to 5⅛″.

HENRY *for low installation cost*

Angle Relief Valve—Type 52

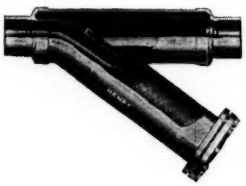
UV ASME—NB—National Board Certified

Forged brass automatic pressure relief valve. Pressure setting range 50 to 450 P.S.I. Size connections: (M.P.T. Inlet x Flare Outlet) ¼″ x ⅜″, ⅜″ x ⅜″, ⅜″ x ½″ and ½″ x ⅝″. Also ⅝″ O.D.S. x ⅝″ O.D.S.



"DRI-COR" Filter-Drier—Type V800

Ceramic fired desiccant filter-core in bed of granular desiccant—a blend of molecular sieves and activated alumina. Provides high capacity drying even at relatively high temperatures, micronic filtration, efficient acid removal and low pressure drop. Pressure sealed. Wide range of sizes with ¼″ thru ⅝″ Fl. connections. "DRI-COR" Filter-Drier Cartridges also available for Henry Cartridge Type Angle Driers.



"Y" Strainer—Type 895

Flanged design permits cleaning without removing strainer from line. Screen cylinders securely located by spring tension preventing by-passing of refrigerant. Forged brass end caps with integral end connections. Screen area: 10 thru 150 sq. in. Size connections: ⅝″ thru 4⅛″ O.D.S. Angle and straight-through type strainers also available.

Write for catalogs describing the complete line.

Catalog 103 Valves, Driers, Strainers and Accessories.

Catalog 202 Ammonia Valves and Accessories.

Catalog FF Forged Carbon Steel Fittings.

HENRY VALVE CO. CONTROLLING FLOW SINCE 1914 ®

HENRY VALVE COMPANY

Manufacturers of Valves, Driers, Strainers, Fittings and Accessories for Refrigeration, Air Conditioning and Industrial Applications.

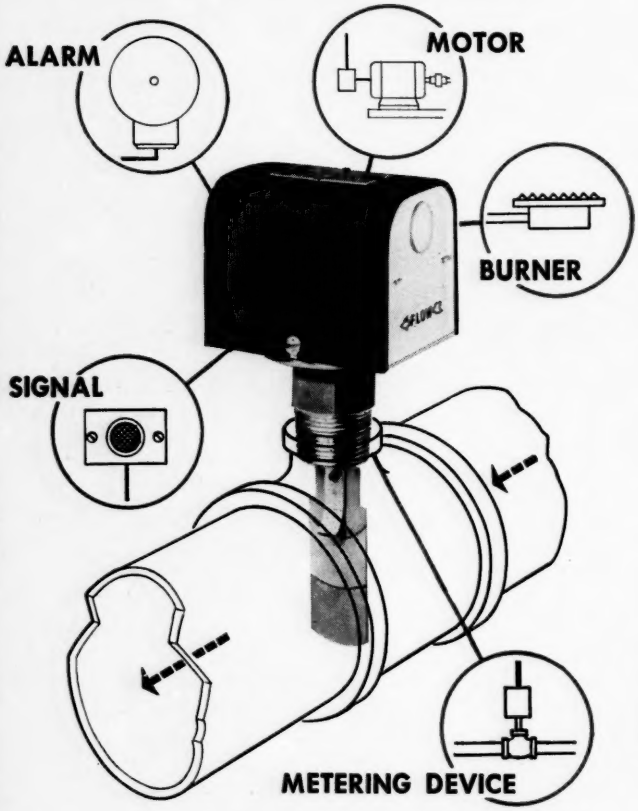
3215 NORTH AVENUE, MELROSE PARK, ILLINOIS (Chicago Suburb)

CABLE: HEVALCO, MELROSE PARK, ILLINOIS

STOP or GO accord

McDONNELL FS4 SERIES FLOW SWITCHES

Versatile new way to start or stop a . . .



Wherever it is important to know if a flow of liquid starts or stops, right there you have a spot for the McDonnell FS4 Series Flow Switch. It is a dependable, moderately-priced device that makes or breaks an electrical circuit when flowing liquid moves the paddle. It's an effective way to provide safer or more automatic operation, available now in compact size and price to fit a broad range of applications.

Write for new bulletin Number FS-1 which shows the many possibilities this new Flow Switch offers as an automatic control or safety device.

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

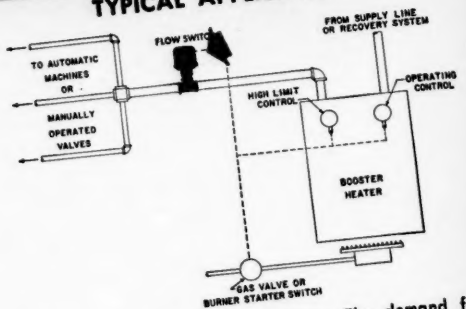
Doing One Thing Well

McDONNELL *Flow Switches*

Your Jobber Stocks Them

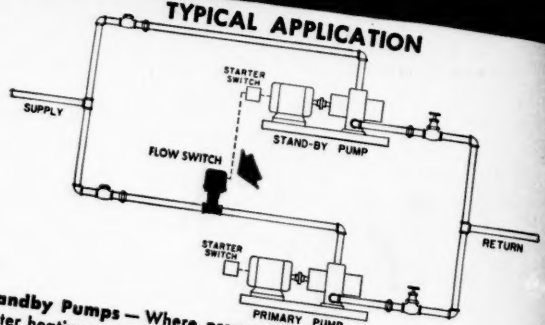
BOILER WATER FEEDERS • LOW WATER FUEL CUT-OFFS • PUMP CONTROLLERS • RELIEF VALVES • RELATED LIQUID LEVEL CONTROLS FOR TANKS, STILLS, AIR CONDITIONING SYSTEMS.

TYPICAL APPLICATION


FROM SUPPLY LINE OR RECOVERY SYSTEM
FLOW SWITCH
TO AUTOMATIC MACHINES OR MANUALLY OPERATED VALVES
HIGH LIMIT CONTROL
OPERATING CONTROL
BOOSTER HEATER
GAS VALVE OR BURNER STARTER SWITCH

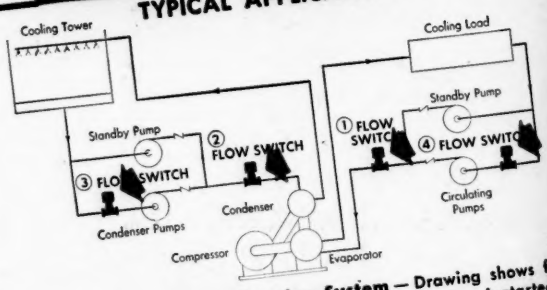
Hot Water Supply for Dishwashers — The demand for 180° water for rinsing tableware in public establishments (and for other commercial processes) frequently requires a booster heater. But the operating control on such a heater may not respond quickly enough, when a sizeable volume of water is drawn, to keep water from falling below 180°. With a flow switch in the line burner is started immediately when a draw of water occurs, to start recovery at once. When flow stops, flow switch returns control to the primary control.

TYPICAL APPLICATION



Standby Pumps — Where proper fluid flow is essential — as in hot water heating and chilled water cooling systems — a standby pump is often installed in parallel with the primary pump. In the system above, a reverse acting flow switch (*breaks* current with flow) is installed in discharge line from primary pump. If pump fails, and flow stops, flow switch cuts in standby pump.

TYPICAL APPLICATION



Chilled Water Air Conditioning System — Drawing shows four flow switches installed in the system. The circulating pump is started in normal manner. When there is sufficient flow, and only then, flow switch No. 1 allows the condenser pump to be started. Similarly, flow switch No. 2 allows compressor to be started when there is sufficient flow of condenser water. Flow switches No. 3 and 4 have reverse-acting switches, automatically cut in standby pump if primary pump fails. Use of the flow switches in this system assures continuous operation, starts system in sequence, stops compressor if there is not proper circulation in system, can be used to report operation on central control panel.